SEPTEMBER 1974

MDC G5456

CR-120725

(NASA-CR-120725) ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY; PROGRAMMATICS REPORT (McDonnell-Douglas Astronautics Co.) 266 p HC $8.50 CSCL 04A

N75-24526

Unclas

G3/81 23177

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY - PROGRAMMATICS REPORT CONTRACT NAS8-30272

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

MCDONNELL DOUGLAS CORPORATION

MCDONNELL DOUGLAS

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – PROGRAMMATICS REPORT
CONTRACT NAS8-30272

SEPTEMBER 1974

MDC G5456

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY-WEST

5301 Bolsa Avenue, Huntington Beach, CA 92647

CONTENTS

INTRODUCTION

This report presents in one volume the results of the programmatics effort conducted during the course of the Zero-Gravity Atmospheric Cloud Physics Experiment Laboratory study (Contract NAS8-30272). The programmatics effort in this study included comprehensive analyses in four major areas: (1) Work Breakdown Structure, (2) Schedules, (3) Costs, and (4) Supporting Research and Technology. These analyses are discussed in detail in the following sections which identify and define the laboratory project development schedule, cost estimates, funding distributions and supporting research and technology requirements. All programmatics analyses are correlated among themselves and with the technical analyses by means of the Work Breakdown Structure which serves as a common framework for program definition. In addition, the programmatic analyses reflect the results of analyses and plans for Reliability, Safety, Test, and Maintenance and Refurbishment.

Section 1
WORK BREAKDOWN STRUCTURE AND DICTIONARY

1.1 INTRODUCTION

The proposed MDAC Cloud Physics Experiment Laboratory Project Work Breakdown Structure (WBS) Dictionary defines the scope of each item in the WBS. In doing so, it provides a means for locating the proper "home" for functions/tasks as they are identified.

1.2 WORK BREAKDOWN STRUCTURE

The Cloud Physics Experiment WBS, Figure 1-1, is a product-oriented display of both hardware and key functions that define the end product to be developed and produced. The WBS serves as a common framework for Program Definition in structuring the technical plan, development schedule, and cost definition. WBS reporting levels are set forth in Table 1-1.

The Cloud Physics Experiment Laboratory Program will be accomplished in three phases. These phases are described as follows:

A. Design, Development, Test and Evaluation (DDT&E) -- This phase consists of the cost of designing, developing, testing, and evaluating an item. Specifically, it includes such items as the following: Development engineering and development support, major test hardware, captive and ground test, ground support equipment, tooling, special test equipment, and site activation.

B. Production -- This phase is defined as the costs associated with producing flight hardware through acceptance of the hardware by the Government including all costs associated with: (1) the fabrication, assembly, and checkout of flight hardware; (2) ground test and factory checkout of flight hardware; (3) initial spares; and (4) maintenance of tooling and special test equipment.

C. Operation -- This phase is defined as the cost associated with the following activities:

   1. Support Operations are defined as (1) replacement spares to support both operational airborne and ground hardware (not GSE), (2) sustaining engineering to support the production of spares and hardware modifications, and (3) maintenance of GSE and spares for GSE.

Table 1-1

ZERO GRAVITY CLOUD PHYSICS EXPERIMENT LABORATORY DEFINITION STUDY

Contract NAS8-30272

REPORTING LEVELS

WBS No.	WBS Identification - System Level Elements	Lowest Level Reported			
		WBS Dictionary	Cost Estimates	Schedules	Funding Estimates
1.0	Project Management	4	4	4	4
2.0	Systems Engineering and Integration	4	5	4	4
3.0	Cloud Physics Experiment Laboratory	5	7	5	5
4.0	Experiment Support Hardware	4	4	4	4
5.0	System Test	4	4	4	4
6.0	Ground Support Equipment	4	5	4	4
7.0	Facilities	4	4	4	4
8.0	Logistics	5	4	4	4
9.0	Ground Operations	5	5	4	4
10.0	Flight Operations	5	5	4	4
11.0	Principal Investigator Operations	5	5	4	4

DEFINITION OF WBS LEVELS

Level No.	Definition
2	Program
3	Project
4	System
5	Subsystem
6	Assembly
7	Component

2. Launch Operations -- The costs for receiving the flight hardware, prelaunch assembly into the Orbiter vehicle, test and checkout, servicing, launching, and post-launch support directly related to the Cloud Physics Laboratory.
3. Mission Operations -- The cost of mission control, mission planning, flight crew training, simulation aids required for crew training (not to include the cost of those items identified elsewhere), and in-flight mission costs directly related to the Cloud Physics Laboratory.
4. Maintenance and Refurbishment Operations -- The cost of activities required to maintain and restore a previously flown reusable system to a flight readiness condition.

The applicability of the various WBS's to these phases is depicted in Table 1-2.

Table 1-2 (Sheet 1 of 2)
EFFECTIVITY OF WBS ELEMENTS

WBS No.	WBS Element	Contract Phase DDT&E	Production	Operations
1.0	Project Management	X	X	X
2.0	System Engineering and Integration	X	X	X
3.0	Cloud Physics Experiment Laboratory			
3.1	Final Assembly Integration and Checkout	X	X	
3.2	Thermal Control/ Expendables Storage and Control	X	X	X
3.3	Particle Generators	X	X	X
3.4	Data Management	X	X	X
3.5	Particle Detectors and Characterizers	X	X	X
3.6	Experiment Chambers and Aerosol Conditioning	X	X	X
3.7	Console	X	X	X
3.8	Optical and Imaging Devices	X	X	X
4.0	Experiment Support Hardware	X	X	X
5.0	System Test	X		
6.0	Ground Support Equipment	X	X	X
7.0	Facilities	X	X	X
8.0	Logistics			
8.1	Training	X		X
8.2	Transportation and Handling	X	X	X
8.3	Inventory Control	X		X
9.0	Ground Operations			
9.1	Recovery Operations			X
9.2	Maintenance/Refurbishment Activities			X
9.3	Checkout Operations and Certification for Flight			X
9.4	Launch Operations			X
10.0	Flight Operations			
10.1	Mission Planning			X
10.2	Flight Control and Evaluation			X

Table 1-2 (Sheet 2 of 2)
EFFECTIVITY OF WBS ELEMENTS

		Contract Phase		
WBS No.	WBS Element	DDT&E	Production	Operations
11.0	Principal Investigator Operations			
11.1	PI Planning Operations			X
11.2	PI Preflight Operations			X
11.3	PI Flight/Postflight Operations			X

WBS DICTIONARY

WBS 0.0 CLOUD PHYSICS EXPERIMENT LABORATORY PROJECT

This summary element contains all labor and material required to design, develop, manufacture, procure, assemble, test, check out and deliver flight Cloud Physics Experiment Laboratory to the Marshall Space Flight Center. Also provided are test articles, mockups, support equipment, training, and flight support activities.

This element is subdivided into:

WBS No.	Title
1.0	Project Management
2.0	System Engineering and Integration
3.0	Cloud Physics Experiment Laboratory
4.0	Experiment Support Hardware
5.0	System Test
6.0	Ground Support Equipment
7.0	Facilities
8.0	Logistics
9.0	Ground Operations
10.0	Flight Operations
11.0	Principal Investigator Operations

WBS 1.0 PROJECT MANAGEMENT

This element contains the effort associated with planning, scheduling, budgeting, controlling, and directing project activities. Also included is the accomplishment of such disciplines as Configuration Management, Performance Management, GFE Management, and Data Management. Customer liaison and contract administration are also performed in this element.

WBS 2.0 SYSTEM ENGINEERING AND INTEGRATION

Overall system analyses, trade studies, weight analysis and weight management, interface control between laboratory systems and the scheduling, check, and release of engineering drawings are performed in this element. Preliminary and final design reviews are coordinated and conducted here. Also included are the preparation of project-level specifications, establishment of test program requirements, cost optimization and safety, reliability, producibility, and quality analyses. Integration of the Cloud Physics Experiment into the Spacelab is included.

All other integration (i.e., Spacelab with other payloads) is the responsibility of others.

WBS 3.0 CLOUD PHYSICS EXPERIMENT LABORATORY

This summary element contains all the labor and materials required to design, develop, manufacture, procure, assemble, test, check out, and deliver flight laboratory units and operational spare parts. Subsystem and component development and qualification tests are conducted. Purchased parts are qualified by the suppliers.

This element is subdivided into:

WBS No.	Title
3.1	Final Assembly, Integration and Checkout
3.2	Thermal Control/Expendables Storage and Control
3.3	Particle Generators
3.4	Data Management
3.5	Particle Detectors and Characterizers
3.6	Experiment Chambers and Aerosol Conditioning
3.7	Console
3.8	Optical and Imaging Devices

WBS 3.1 FINAL ASSEMBLY, INTEGRATION, AND CHECKOUT

This element contains all labor and material required to integrate the various system modules into a viable laboratory. Final assembly, including attachment and installation hardware, final factory acceptance operations, packaging/crating, and shipment to KSC are included. Also included are the preparation of final factory acceptance checkout procedures, manufacturing liaison, and the coordination and accomplishment of customer acceptance of the completed articles.

WBS 3.2 THERMAL CONTROL/EXPENDABLES STORAGE AND CONTROL

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect, and check out the thermal control and the storage and control of expendables. Also included are: design and fabrication/purchase of test specimens and operational spares; preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling, and production planning.

This element is further subdivided into:

WBS No.	Title
3.2.1	Integration, Assembly, and Checkout
3.2.2	Thermal Control
3.2.3	Flow, Humidity, and Pressure Control
3.2.4	Expendables Storage
3.2.5	Instrumentation and Display Subassembly
3.2.6	Expendables
3.2.7	Cleansing Purge and Vent Subassembly

WBS 3.3 PARTICLE GENERATORS

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect, and checkout the particle generators. Also included are: design and fabrication/purchase

of test specimens and operational spares; the preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.3.1	Integration, Assembly, and Checkout
3.3.2	Wire Probe Retractor Generator
3.3.3	Water Drop Impeller Generator
3.3.4	Vibrating Orifice Generator
3.3.5	Evaporator/Condenser Generator
3.3.6	Spray Atomizer Generator
3.3.7	Powder Dispersion Generator
3.3.8	Particle Injector and Size Conditioner
3.3.9	Instrumentation/Displays

WBS 3.4 DATA MANAGEMENT

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect and check out the data management subsystem. Also included are: design and fabrication/purchase of test specimens and operational spares; the preparation of engineering drawings, procedures, and specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.4.1	Integration, Assembly, and Checkout
3.4.2	Control Processor Assembly
3.4.3	Tape Recorder Assembly*
3.4.4	Master Control Assembly

*Furnished by Spacelab or GFE.

WBS No.	Title
3.4.5	Signal Conditioning Electronics Assembly
3.4.6	Instrumentation and Display Assembly
3.4.7	Expendables
3.4.8	Cable Assemblies

WBS 3.5 PARTICLE DETECTORS AND CHARACTERIZERS

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect and check out the particle detectors and characterizers subsystem. Also included are: design and fabrication/purchase of test specimens and operational spares; the preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.5.1	Integration, Assembly, and Checkout
3.5.2	Optical Particle Counter
3.5.3	Pulse Height Analyzer
3.5.4	Condensation Nucleus Counter
3.5.5	Microporous Filter
3.5.6	Quartz Crystal Mass Monitor
3.5.7	Cascade Impactor
3.5.8	Electrical Aerosol Size Analyzer
3.5.9	Scatterometer
3.5.10	Liquid Water Content Meter
3.5.11	Droplet Size Distribution Meter
3.5.12	Optical Thermoelectric Dew Point Hygrometer
3.5.13	Electric Dew Point Hygrometer
3.5.14	Instrumentation/Displays

WBS 3.6 EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect and check out the experiment chambers and aerosol conditioning. Also included are: design and fabrication/purchase of test specimens and operational spares; the preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.6.1	Integration, Assembly, and Checkout
3.6.2	Static Diffusion Liquid Chamber Assembly
3.6.3	Static Diffusion Ice Chamber Assembly
3.6.4	General Chamber Assembly
3.6.5	Expansion Chamber Assembly
3.6.6	Continuous Flow Diffusion Chamber Assembly
3.6.7	Earth Simulation Chamber Assembly
3.6.8	Nuclei Conditioning Assembly

WBS 3.7 CONSOLE

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect, and check out the console subsystem, including the console support structure and subassembly (mounts, packages, restraints and tools), and power control and distribution assembly. Also included are design and fabrication/purchase of test specimens and operational spares; the preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.7.1	Integration, Assembly, and Checkout
3.7.2	Console Support Structure and Subassembly
3.7.3	Power Control and Distribution
3.7.4	Console Panels and Drawer Subassembly
*3.7.5	Overhead Storage Subassembly
*3.7.6	Floor Segment Subassembly
3.7.7	Instrumentation/Displays

WBS 3.8 OPTICAL AND IMAGING DEVICES

This summary element contains all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect, and check out the optical and imaging devices subsystem. Also included are: design and fabrication/purchase of test specimens and operational spares; the preparation of engineering drawings, procedures, specifications; supplier qualification and coordination; design and fabrication of tooling; production planning.

This element is further subdivided into:

WBS No.	Title
3.8.1	Integration, Assembly, and Checkout
3.8.2	Cine Camera (35 mm)
3.8.3	Still Camera (35 mm)
3.8.4	Microscope Trinocular
3.8.5	Video Camera Assembly (16 mm)
3.8.6	Light Source
3.8.7	Anenometer
3.8.8	Stereo Microscope
3.8.9	IR Microscope
3.8.10	Support Equipment/Expendables
3.8.11	Displays

*Note: No need identified. Provided by Spacelab at no cost to CPL.

WBS 4.0 EXPERIMENT SUPPORT HARDWARE

This WBS element is presently for reference only as, to date, no payload-unique support equipment is identified with CPL. If such equipment becomes existent, this element shall contain all labor and material necessary to design, manufacture, procure, assemble, test (development and/or verification), inspect and check out the experiment support hardware. Included are the hardware, equipment (including ancillary equipment) not provided by others (i.e., Spacelab), but which are required for integration of the Cloud Physics Laboratory into the Spacelab and for assurance of proper operation of the Cloud Physics Laboratory after it has been integrated.

WBS 5.0 SYSTEM TEST

In this element are performed the planning, coordination, design, setup, conduct and evaluation of the system-level development and verification tests. Also provided are all effort and materials required to design, build and maintain system-level test articles. Hardware unique to the system-level tests is designed and manufactured or purchased and test procedures are prepared. In a similar manner, hardware and software unique to the mockup are provided.

This element is subdivided into:

WBS No.	Title
5.1	System Test Planning
5.2	Major Test Articles
5.2.1	Mockups
5.2.2	Functional Model
5.2.3	Project Verification Model
5.3	System Development Testing
5.4	System Verification Testing

WBS 6.0 GROUND SUPPORT EQUIPMENT (GSE)

The design, manufacture, procurement, assembly, test, checkout and calibration/maintenance of ground support equipment (GSE) is performed in this WBS element. This equipment is used to handle, service or check out the various laboratory subsystems, either individually or collectively, during factory acceptance checks or launch operations. Included are: design and fabrication/purchase of all hardware; spares; the preparation of engineering drawings, procedures, specifications; manufacturing liaison; supplier qualification and coordination; design and fabrication of tooling; production planning; and any software peculiar to the GSE.

This element is subdivided into:

WBS No.	Title
6.1	GSE Integration
6.2	Electrical GSE
6.3	Mechanical GSE
6.4	Transportation and Handling GSE
6.5	GSE Software

WBS 7.0 FACILITIES

If new facilities, or modifications to existing facilities, are required, they are provided in this WBS element. Included are the planning, coordination, design, fabrication, procurement, inspection, installation, setup, checkout, acceptance, and activation of these facilities. Facility operation and maintenance are provided in this element. Facility operation and maintenance related to manufacturing facilities is a manufacturing cost. Facility operation and maintenance associated with launch and flight operations is an operations cost.

This element encompasses the following subelements:

WBS No.	Title
7.1	Manufacturing Facilities
7.2	Test Facilities
7.3	Launch Facilities

WBS 8.0 LOGISTICS

This WBS summary element contains the effort to implement, operate, and maintain a logistics management for support of the Cloud Physics Laboratory and its related support equipment, including transportation, handling, factory warehousing and inventories, systems orientation and familiarization, training of ground crew personnel, and the design, development and manufacture of those distinctive end-items required specifically to meet the training objectives. Included are operational maintenance trainers, cutaways, and models.

This element is subdivided into:

WBS No.	Title
8.1	Training
8.2	Transportation
8.3	Inventory Control

WBS 8.1 TRAINING

This WBS element contains the effort required to develop training aids to operate, maintain, repair/refurbish, handle, and check out specific Cloud Physics Laboratory mission timelines. Included are the establishment of requirements, the preparation of instructional materials, conduct of classes, maintenance of necessary records. All other training is the responsibility of others, i.e., Spacelab.

This element is subdivided into:

WBS No.	Title
8.1.1	Planning
8.1.2	Training Aids
8.1.3	Conducting Classes

WBS 8.2 TRANSPORTATION AND HANDLING

This WBS element refers to the preparation for, and transportation of, major items of equipment and hardware which have special requirements due to their size, weight, shape, or environmental control. Transportation of items not requiring such special considerations is included within the specific vehicle or ground subsystem element. Transportation of the total Cloud Physics Laboratory between manufacturing assembly facility and launch site is included in this element. Special equipment required for handling and transporting the Cloud Physics Laboratory is included under WBS 6.4 - Ground Support Equipment Transportation and Handling.

WBS 8.3 INVENTORY CONTROL

This WBS element refers to warehousing and inventory controls of materials, parts, supplies, tooling, equipment, and spares provisioning in support of maintenance and refurbishment of the Cloud Physics Laboratory. Included are costs of inventory control computer software and control system maintenance.

WBS 9.0 GROUND OPERATIONS

Within this WBS summary element are provided all activities associated with launch and recovery operations and the maintenance/refurbishment activities of the Cloud Physics Laboratory.

This WBS element is subdivided into:

WBS No.	Title
9.1	Recovery Operations
9.2	Maintenance/Refurbishment Activities
9.3	Checkout Operations and Certification for Flight
9.4	Launch Operations

WBS 9.1 RECOVERY OPERATIONS

This WBS element contains all efforts associated with the planning, coordination, and implementation of recovery activities. Included are such tasks as coordination of schedules, preparation of handling and demating procedures unique to the recovery operations, participation in recovery working groups, liaison and technical representation at recovery site. The overall integration and conduct of recovery operations will not be performed by the CPL project.

WBS 9.2 MAINTENANCE/REFURBISHMENT ACTIVITIES

Maintenance and refurbishment of flight hardware take place in this WBS element. Also included are the coordination activities leading to the establishment of requirements and subsequent procedure preparation and validation, participation in working groups, liaison between the maintenance/refurbishment site and the home plant, postflight inspection of flight hardware. The task of overall coordination and integration of these activities will not be performed by the Cloud Physics Laboratory Project.

WBS 9.3 CHECKOUT OPERATIONS AND CERTIFICATION FOR FLIGHT

This WBS element contains the tasks associated with the checkout and certification for flight of the refurbished CPL. Included are the coordination activities leading to establishment of test criteria, preparation of tests procedures, participation in working groups, and liaison concerning all phases of CPL operations that could impact flight status. The task of overall STS coordination and integration of these activities is greater than, and will not be performed by, the CPL project.

WBS 9.4 LAUNCH OPERATIONS

The efforts to support the launch checkout and integration are included in this WBS element. Included are coordination and implementation of all CPL-related launch activities, coordination of schedules, preparation of handling and checkout criteria

and procedures, participation in launch working groups, liaison between other activities and the launch site, and technical representation at the launch site. The overall integration of prelaunch and launch activities and conduct of the overall STS launch site operations are greater than, and will not be performed by, the CPL project.

WBS 10.0 FLIGHT OPERATIONS

This summary element contains those activities peculiar to flight operational aspects of the laboratory. Overall integration and coordination of these activities are not performed by the Cloud Physics Laboratory Project.

The subdivisions of this WBS element are:

WBS No.	Title
10.1	Mission Planning
10.2	Flight Control and Evaluation

WBS 10.1 MISSION PLANNING

This WBS element contains the activities associated with the establishment of mission requirements, the preparation of in-orbit procedures, the preparation of crew timelines, the coordination of earth-to-orbit communications and data requirements, and participation in mission planning working groups.

WBS. 10.2 FLIGHT CONTROL AND EVALUATION

This WBS element includes those activities peculiar to in-flight operation of the Cloud Physics Laboratory. Postflight quick-look evaluation of data and the preparation (i.e., formatting) of postflight reports occur in this element.

Subsystem in-flight performance data for the laboratory will be reduced and evaluated to determine maintenance and refurbishment requirements.

WBS 11.0 PRINCIPAL INVESTIGATOR OPERATIONS

This WBS element summarizes those activities performed only by the principal investigator(s) (PI) which are not provided or funded by other agencies.

This element is divided into:

WBS No.	Title
11.1	Principal Investigator Planning Operations
11.2	Principal Investigator Preflight Operations
11.3	Principal Investigator Flight/Postflight Operations

NOTE: Materials and services provided by others in support of the PI are not included in this element.

WBS 11.1 PRINCIPAL INVESTIGATOR PLANNING OPERATIONS

This WBS element includes the PI activities, associated with but not limited to, the formulation of experiment mission objectives and the definition of experiment mission laboratory equipment.

WBS 11.2 PRINCIPAL INVESTIGATOR PREFLIGHT OPERATIONS

This WBS element contains the PI effort expended in the coordination of astronaut training and the formulation of mission timelines and other similar activities.

WBS 11.3 PRINCIPAL INVESTIGATOR FLIGHT/POST-FLIGHT OPERATIONS

This WBS element contains the PI effort of performing in-flight operations (real-time instructions and evaluations), astronaut debriefing, detailed experiment mission data reduction, and evaluation and preparation of experiment mission reports.

Section 2
SCHEDULES

2.1 SUMMARY

The schedules prepared in this study comprise the effort defined in the WBS for all phases of the Zero-Gravity Cloud Physics Experiment Laboratory (CPL) project, from definition/preliminary design (Phase B) through design, development/operations (Phase C/D). The schedules are structured to be consistent with the WBS, the available program definitions, and ground rules established for the study. Major program and interfacing milestones established in the project schedule are the basis for activity timing and sequence at all levels of schedule development. Schedule timing and estimates are commensurate with the project definitions and the relative level of study effort at this time; and with the understanding that they are for preliminary planning and tradeoff purposes only.

Schedules (Figure 2-1; 2-2, and 2-3) are presented in a format consistent with a Phase A level of effort. They identify hardware, prototypes, models, and early technology suitable for evaluation of design, performance, and production. Components and contract items requiring early development, critical performance, or specialized testing are sequenced in proper relation to higher level requirements. Detail design, development, test, and evaluation of hardware, software, and procedures are indicated as well as supporting equipment, systems engineering, and integration and project management needed to complete the program documentation.

Three major activities are required to achieve the schedules: (1) a supporting research and technology program in direct support of the CPL concept; (2) a combined design, development, and operational phase (C/D); and (3) the development of cloud physics experiments in essentially the same period and in parallel with the CPL project.

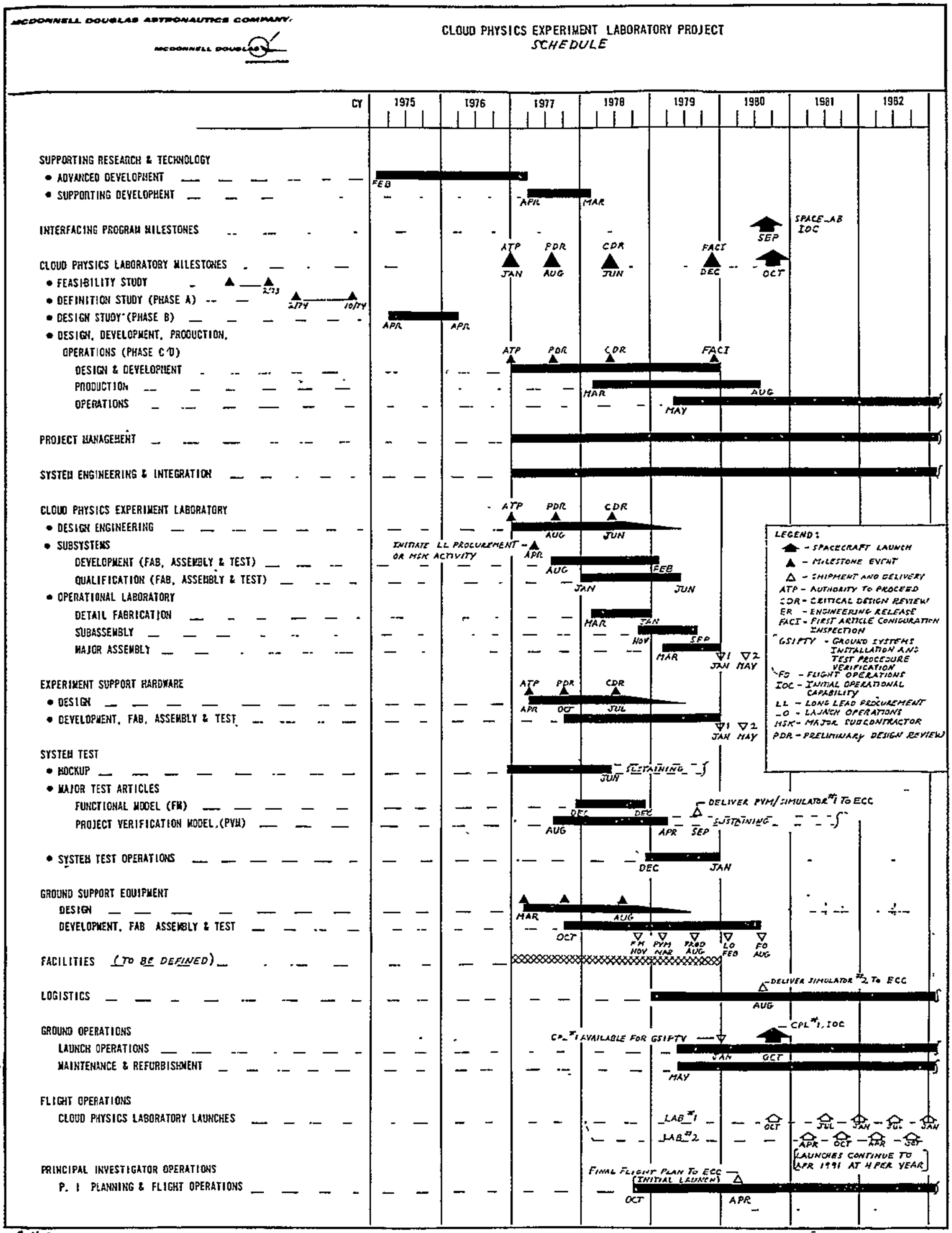


Figure 2-1. Cloud Physics Experiment Laboratory Project Schedule

ORIGINAL PAGE IS
OF POOR QUALITY

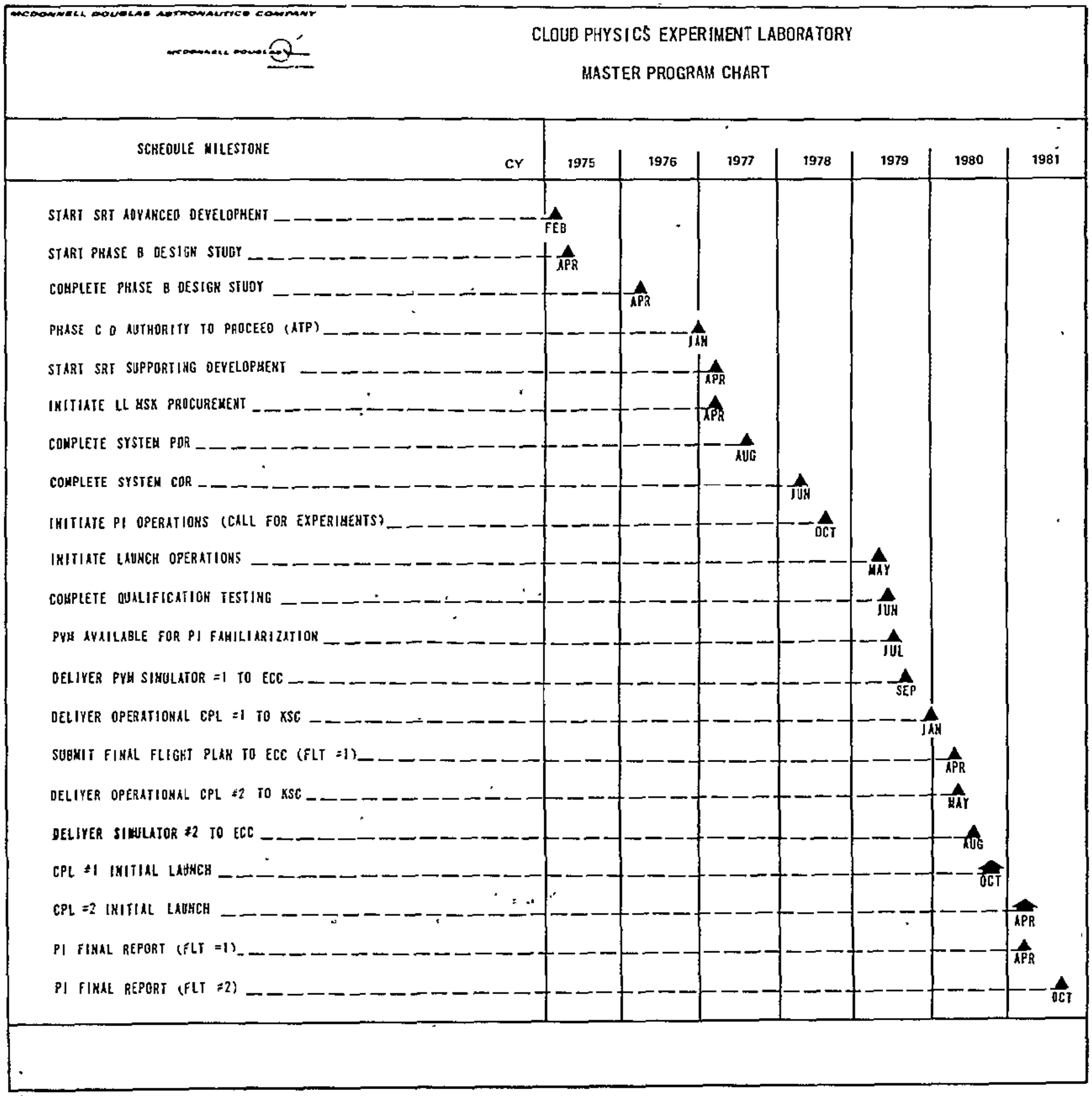


Figure 2-2. Cloud Physics Experiment Laboratory Master Program Chart

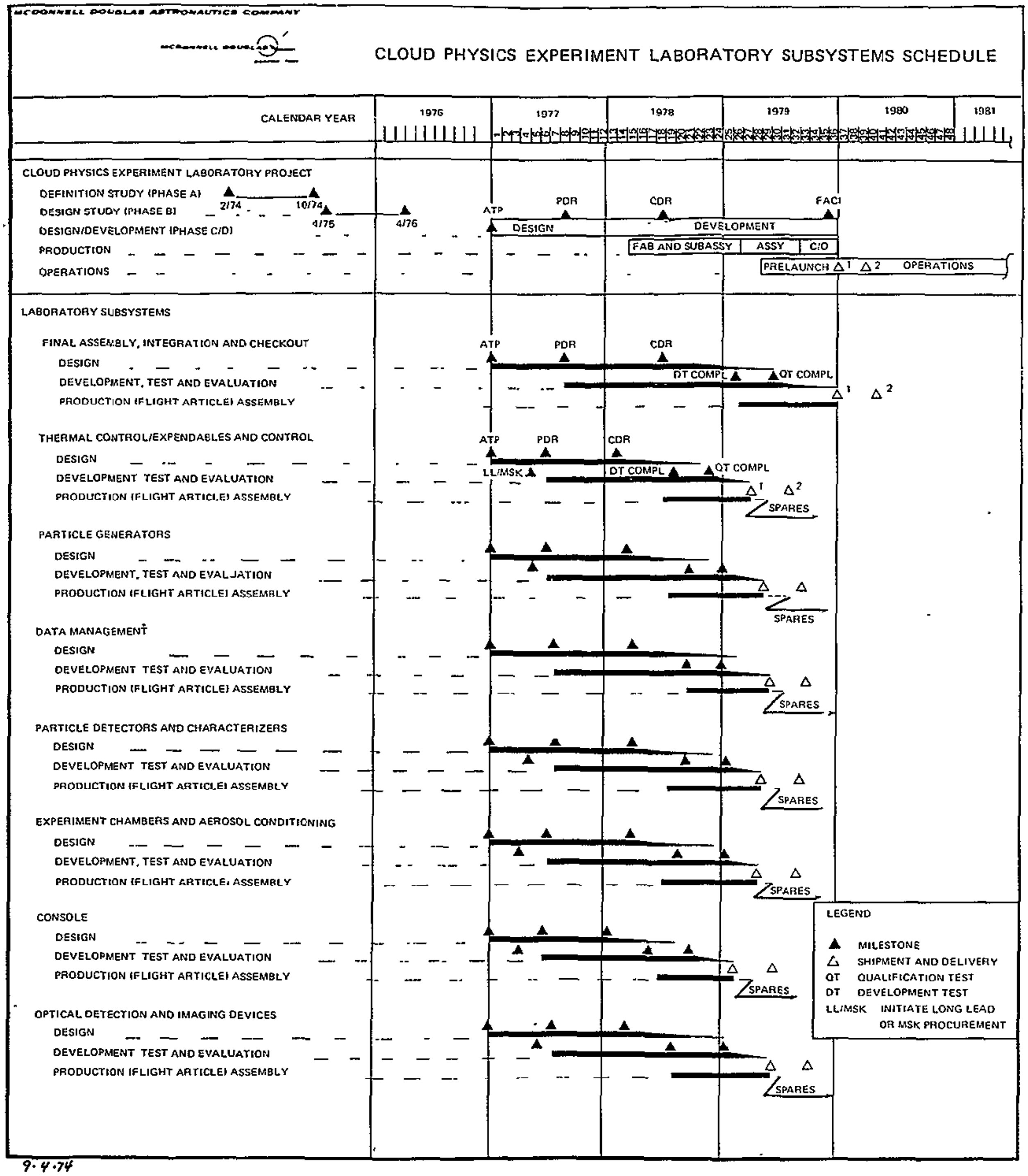


Figure 2-3. Cloud Physics Experiment Laboratory Subsystems Schedule

Time-phasing with the SRT program must be established coincident with requirements for definition, design and development of the CPL project systems. Advanced Development will contribute to the early Phase C/D and must be completed in the early design period to prevent schedule impact. Supporting Development activity decision action will occur several months before final engineering design is complete.

2.2 SCHEDULE GUIDELINES

The ground rules established to provide reasonable boundaries within which to define the project schedules are:

A. Begin to conduct Cloud Physics Experiment Missions 02 October 1980.

B. Deliver first CPL Operational Vehicle (OV) to the launch site 9 months before launch (03 January 1980);

C. Consider experiment carrier to be Spacelab/Space Transportation System.

D. Provide for program operations to extend through CY 1991.

E. Assume Spacelab/STS to become available as required to support CPL launches.

F. Assume 6 month turnaround time, launch to launch, for the CP.

G. Assume total system definition is accomplished prior to the start of hardware development.

H. Provide hardware procurement, fabrication, assembly, and test quantities as noted:

1. Procure critical material for all requirements on first buy; prototype and production.
2. Fabricate all parts on one order except as noted below.
3. Assemble prototype and qualifiable parts at the same time (PVM and qualification test).
4. Assembly qualifiable parts for OV's following QT assemblies.
5. Retain FM at MDAC as an engineering model for future changes.
6. Usable subsystem portions left after Development Testing are sent to FM.
7. Usable subsystem portions left after Qualification Testing (75 percent) are sent to the PVM (then to simulator).

8. PVM is delivered to ECC for use as a simulator, after factory completion and checkout.
9. A second simulator is assembled from qualification parts following second production unit (See item 7).
10. Spacelab is considered a vendor for purposes of obtaining Spacelab parts for use in the CPL.

The combined Phase C/D will be initiated in January 1977. Phases C and D are addressed as combined; however, they are depicted separately on schedules in order to identify critical key milestones which impact lower level schedules. Early activity in Phase C/D will provide a realistic statement of technological capability, a detailed system design to meet hardware specification requirements and detailed implementation, development and budgetary plans. Several key project milestones are indicated on CPL schedules and must be achieved if project commitments are to be met.

2.3 PROJECT SCHEDULE FACTORS

Test philosophy activity has identified the CPL test articles to be utilized in the ground test program for integration activities and multiple system testing. Subsystem and system integration testing and software development will be performed on two major test articles, one of which is referred to as the Functional Model (FM) and the other as the Project Verification Model (PVM). The planning is organized to limit the models to a minimum number and yet satisfy the development and operational requirements. An example of this is the utilization of the PVM for (1) manufacturing development and tool fabrication; (2) factory system integration testing, software development, and operating procedure development; (3) training and mission planning; and (4) integration of experiments and checkout of CPL modifications for update installation. Development of the GSE is accomplished in connection with development of the FM and PVM.

The FM is a development tool that is functionally equivalent to an operational vehicle but in a rack-and-panel type assembly. The FM utilizes qualifiable

type, prototype, flight equivalent, and simulated aerospace vehicle equipment (AVE). The major objective of the FM is to perform interface development testing among AVE subsystem and between AVE subsystems and GSE in preparation for support of the system level integration and development testing. The FM will be maintained at the factory as a development tool for interface verification of later requirements for update installation.

The initial use of the PVM is to provide a check of the physical compatibility of subsystem design configurations early in their development. Non-operational subsystems are used for manufacturing development and tool fabrication. The primary objectives are:

A. To verify manufacturing methods.
B. To check assembly procedures.
C. To assist in determining tooling requirements.
D. To establish control line and cable routing.
E. To establish electrical wire harness routing.
F. To verify component accessibility.
G. To develop and verify maintenance procedures.
H. To facilitate design change feedback.
I. To serve as an additional man system procedure definition tool.
J. To verify mechanical clearances.

Some time prior to completion of fabrication, flight equivalent subsystems will be utilized in the PVM. From this time forward and prior to CPL launch, the PVM includes people, procedures, facilities and production equipment and is used to verify development completion of the CPL at the factory and at KSC. At the factory, the PVM will be used for system integration testing, software development and operating procedure development. This model will be produced in the same factory manufacturing and testing facilities where the operational vehicle is produced. Following manufacturing and checkout at the factory, the PVM will be delivered to ECC. This model will be used for training and mission planning purposes as well as installation of experiments and checkout of CPL modifications for update installation.

Mockups are relatively inexpensive development tools which prove invaluable in early verification of many facets of the design. The installation mockup, which will be updated from the Phase C activity, will be maintained to reflect the current design as the design progresses toward the operational phase. The mockup will be used as a development tool for optimizing man/system interface relationships.

Preliminary schedule planning indicates a need for one set of GSE for the FM, one set of GSE for the PVM, which will be utilized at the factory and shipped with the unit for support of mission integrator activity, and two sets of operational CPL GSE. One operational set is to be used at the factory and shipped to the launch facility with the first operational CPL. An additional set is required at the factory to support production and acceptance testing of the second operational CPL and the CPL simulator. This second set is then delivered with the simulator and is available as a backup at ECC or the launch site.

In addition to test article and operational GSE there will be experiment, launch and flight operations GSE. Launch operations GSE is required to support the CPL or experiments during preparation and launch at the launch facility. Flight operations GSE includes any specialized equipment required for flight operations, communications and command and control of the CPL and installed experiments.

Launch operations will begin with receipt of the CPL and GSE at the launch site approximately 9 months before launch. CPL checkout, CPL/Spacelab interface verification, and complete system checkout will be performed; and final installation of experiments suitable for launch site installation will be completed. Normal integration and system tests will be performed and the CPL launched on board a Spacelab via the Space Transportation System (STS).

2.4 LABORATORY SCHEDULE

The CPL Project Schedule (Figure 2-1) includes the Cloud Physics Laboratory and experiment support equipment. In addition to the flight hardware are the project management, system engineering and integration, system test, ground support equipment, facilities, logistics, ground operations, flight operations and Principal Investigator operations, required to support the design, development, launch and mission operations of the CPL.

A schedule for each of the CPL project areas is presented in Figure 2-1. These schedules identify the project 1 laboratory level requirements and the activities required. The schedules show major milestones and key events related to each area. The master program chart, F gure 2-2, presents the major milestones from initiation of SRT-advanced development through completion of Flight 2 Principal Integration final report.

2.4.1 Supporting Research and Technology (SRT)

Advanced Development

The activities normally start during the definition phase (Phase B), but in some selected cases may start some months prior to this time and extend into the design phase (Phase C). The prime concern is to firm up the performance requirement specification prior to the start of development.

Supporting Development

The activities lead to the development of backup or alternate subsystem and/or components. The effort should be concurrent with the major development effort during the design phase (Phase C).

2.4.2 Interfacing Milestones

These activity milestones are taken from information furnished by the customer and/or participating interfacing program contractors.

2.4.3 Cloud Physics Laboratory Milestones

A. ATP - Authority to Proceed - customer-directed date.

B. CDR - Critical Design Reviews are formal technical reviews of the design of a contract end item. This effort should be accomplished

when the design is essentially complete to formally establish a basis for release of contract end item design and supporting activities for manufacture.

C. FACI - First Article Configuration Inspection is a formal technical review to establish the similarity between the manufactured hardware and the released engineering and to verify that the vehicle has been proven capable of being used as originally intended through other associated test programs. This effort takes place following manufacturing completion and prior to factory delivery.

D. IOC - Initial Operational Capability - Customer-directed launch date. Launch of the first production vehicle capable of performing the intended mission.

E. PDR - Preliminary Design Review is a formal technical review of the basic design approach for a contract end item. The PDR is accomplished early in the development phase (Phase D) to establish the system compatibility of the design approach.

2.4.4 Project Management

This effort encompasses the planning, scheduling, budgeting, controlling, and directing of project activities. Starting at ATP it is continuous throughout the life of the program.

2.4.5 System Engineering and Integration

Initiated at ATP, the SE&I is the overall analysis and control of the Cloud Physics Laboratory engineering requirements, specifications, drawings, interface compatibility, and integration. The effort is continuous to a varying degree throughout the program.

2.4.6 Cloud Physics Laboratory

2.4.6.1 Design Engineering

The objective of design engineering is the translation of the requirements of the Cloud Physics Laboratory project specifications into the detailed design

of the operational system. Design reviews are required to measure compliance with specific design accomplishments. The effort that was initiated at ATP continues at a relatively even level of effort through CDR, tapering to zero with the release of final installation drawings. All effort following final drawing release is defined as sustaining engineering.

2.4.6.2 Subsystems

Development (Fabrication, Assembly, and Test)

Subsystem development takes place over the period from PDR to the start of final qualification testing to determine and evaluate the design feasibility and to demonstrate that the design meets the specified requirements. Included are the fabrication assembly and integration of test specimens.

Qualification (Fabrication, Assembly, and Test)

Subsystem qualification tests, performed to demonstrate specification compliance, start with the first qualifiable hardware available following critical design review of a specific item. All tests are expected to be complete no later than the mid-point of system test operations taking place on the PVM.

2.4.6.3 Operational Laboratory

Detail Fabrication

Fabrication of CPL production details is initiated with the release of engineering drawings, following CDR, and continues as necessary to support sub and major assembly of the operational laboratory.

Subassembly

Starting with the availability of first production details, subassembly is expected to be complete with the delivery of the final unit midway through major assembly.

Major Assembly

Subsystem installation, integration, factory checkout, and final acceptance are included in major assembly. Activity starts with the availability of the first completed subassemblies, in line with completion of PVM subsystem

installation and integration which provides proven methods and learning developed during the PVM assembly. Activity is complete when the vehicle is delivered to the launch site.

2.4.7 Experiment Support Hardware

2.4.7.1 Design

Design of experiment support hardware lags the design of the CPL by from one to two months to allow for availability of CPL design information effecting the ESH.

2.4.7.2 Development, Fabrication, Assembly, and Test

This activity, although lagging at the start because of design, is approximately in parallel with like events of the operational laboratory and will be complete at the same time.

2.4.8 System Test

2.4.8.1 Mockups

This is a continuing and expanding effort that was started in Phase B. The effort is expected to be 90 percent complete before CDR, followed by only minor activity for new development or change requirements.

2.4.8.2 Major Test Articles

Functional Model

Activity is initiated with the fabrication of racks and installation of breadboard subassemblies, following PDR. Subsystem installation and integration and functional testing is expected to be completed to support the start of test operations on the PVM.

Project Verification Model (PVM)

PVM assembly start is synomymous with the initiation of manufacturing development and tool fabrication. This is just prior to final PDR. PVM activity continues through the installation and integration of subsystems and test operations. Activity completion is timed to coincide with the start of factory checkout on the first production vehicle.

2.4.8.3 System Test Operations

This effort starts with initial test operation of the FM, includes test operation of the PVM, factory checkout of the production vehicle, and is complete with final acceptance test and preparation for delivery.

2.4.9 Ground Support Equipment

2.4.9.1 Design

Ground support equipment design lags CPL design by 2 months to ensure compatibility.

2.4.9.2 Development, Fabrication, Assembly, and Test

Starting at PDR completion, the GSE development cycle continues through the completion of flight operations equipment, 2 months before first CPL launch.

2.4.10 Facilities

No CPL-unique facility requirements have yet been identified. Generally, facilities planning identifies requirements peculiar to the CPL project in Phase B and continues into Phase C to include new facilities, modifications to existing facilities, documentation requirements, and interrelationships with other elements of the national space program. Specifications, A&E design, construction and activation follow in this order. The effort is complete with launch facility modification and reactivation about the time of first flight hardware delivery.

2.4.11 Logistics

Support prelaunch operations, following CPL and GSE Engineering release. Activities are initiated with the establishment of requirements for hardware and software. Logistics support to the CPL project is a continuing effort including Training, Transportation and Handling, and Inventory Control.

2.4.12 Ground Operations

2.4.12.1 Launch Operations

Launch operations comprise the hardware and software activities involved directly in the prelaunch and launch operations at the launch site. This activity is initiated approximately 8 months before first CPL launch with the requirements and procedures identification. Site activation, assembling delivered CPL equipment, servicing, installation of the CPL in the Spacelab, checkout, postflight removal of the CPL, etc., are continuing functions for the life of the program.

2.4.12.2 Maintenance and Refurbishment

This activity takes place in parallel with the launch operations activity to identify the requirements and procedures needed to accomplish this task and to complement that activity. It also is a continuing effort for the life of the program.

2.4.13 Flight Operations for Cloud Physics Laboratory Launches

Flight operations activity of the CPL start with launch of the first operational vehicle and continue in support of each launch and on-orbit operation for the life of the program. This includes the availability of technical personnel in an advisory capacity and the resolution of real-time CPL problems.

2.4.14 Principal Investigator Operations

2.4.14.1 Planning and Flight Operations

This activity, performed by the principal investigator(s), is initiated early in the program to formulate the experiment mission objectives and define the experiment mission laboratory equipment. It is a continuing effort including coordination of astronaut training, formulation of mission timelines, performing in-flight operations, debriefing, data reduction, and preparation of experiment mission reports.

2.4.14.2 Support Equipment

Principal investigator support equipment is unique to Principal investigator requirements not supported by other CPL systems. Design, development, test, and evaluation of this equipment starts early in the program, following the basic CPL requirements definition. The equipment is produced, checked out, and delivered as necessary to support Principal Investigator operations activity but not later than delivery of the first operational CPL to the launch site.

2.5 SUBSYSTEM SCHEDULES

The Cloud Physics Laboratory (CPL) (WBS 3.0) is composed of the following subsystems:

WBS No.	Subsystem
3.1	Final Assembly, Integration and Checkout
3.2	Thermal Control/Expendables and Control
3.3	Particle Generators
3.4	Data Management
3.5	Particle Detectors and Characterizers
3.6	Experiment Chambers and Aerosol Conditioning
3.7	Console
3.8	Optical Detection and Imaging Devices

Figure 2-2 defines the development/production master schedule for the CPL.

The schedules show design, development, test, and manufacturing requirements. CPL subsystem level activities presented include design engineering, subsystem development test, qualification test and deliveries and operational vehicle manufacturing requirements.

The composite subsystem development and qualification test time spans are established based on the CPL system level time requirements as constrained by the program phase durations. The individual subsystem development and qualification testing is performed initially during the test time spans allocated. Subsystem integration testing in the functional model (FM) and project verification model (PVM) is then performed at the CPL system level.

A schedule for each of the subsystems is presented in Figure 2-3. These schedules identify subsystem level requirements and development activities required to design, test, and produce the subsystems. The schedules show major milestones, key events, and critical actions related to each subsystem.

Subsystem Design, Development, Test and Evaluation (DDT&E) begins with Phase C/D ATP and ends at qualification test completion. Manufacturing time spans begin with nonoperational units for mockup and PVM and end when manufacturing of production units for spares is complete. Nonoperational units are required for mockups and the project verification test article (PVM) during early manufacturing development and tool fabrication. Nonqualification units are required for development test and the functional test model (FM). Qualification units are required for qualification testing, for PVM subsystem assembly, integration and system verification testing, and for the completion of the CPL simulator. Production (flight article) units are supplied for two CPL operational vehicles and to support the spares requirements.

The schedules represent the time-related synthesis of a number of influencing factors, which are discussed in the following paragraphs.

Two non-qualification units are produced for each subsystem. One unit of the console subsystem is shipped directly to the PVM. One unit of each of the other subsystems is used for development testing of the subsystem. The second nonqualification unit of each subsystem is shipped directly to the FM.

Two qualification units are produced for each subsystem. The first unit is used for qualification testing. At the completion of qualification testing the usable portion of the subsystem (75 percent) is shipped to the simulator. An additional 25 percent of an equivalent subsystem is produced and shipped directly to the simulator. Assuming successful qualification test using the first unit, the second qualification unit is shipped directly to the PVM upon completion of manufacture. Additional testing is performed early in the development phase at the component, subassembly and assembly levels.

The CPL subsystems will require unique design, development and test activities. Those systems defined as major problem areas will require extensive investigation, development and qualification. Many of the components and assemblies have been employed in other programs and are categorized as standard equipment design. However, difficulties relating to modification of commercial and terrestrial laboratory equipment required to withstand launch loads and zero-g environments and development of new equipment, will necessitate detail attention and development verification to assure that all technical requirements are achieved.

The requirement to design, develop, test, and produce the Cloud Physics Laboratory within a 36-month period and the expected long-lead procurement/ major subcontractor delivery of components and subassemblies precludes the use of historical schedule practice in some areas. Schedule compression is reflected in development and qualification test overlaps, minimum assembly and integration time, early initiation of long-lead procurement/major subcontracts, ATP, and greater dependence on SRT advance development.

The subsystems are composed of many different assemblies that require integration within each other and with the configuration. A diversity of technology is required to develop successful subsystems, including high-pressure gas storage, atmosphere pressure and composition control, vacuum pumping, temperature and humidity control, droplet charge distribution, particle generation, heat transfer and electromechanical control.

There are areas of technical capability in the experiment chambers/aerosol conditioning and the particle generator subsystems that are unique and require special attention during the design and development period. Included is particle generation, particle detection, and chamber wall integration. A development test program to investigate details of design and material use along with persistent attention to detail is required to provide the high reliability to support experiment conclusions.

Key subystem level problems are: (1) the integration of the many assemblies so that they are compatible with each other, and (2) the integration of these assemblies into the configuration. Many of these assemblies, such as atmosphere temperature control and the heat transfer circuits, are sensitive to the configuration. Therefore, it is vital to complete integrated subsystem level tests before final qualification of assemblies.

An additional 6 months, 42 months from ATP to first production delivery, would benefit the overall project by allowing development, evaluation and qualification to take place in a more timely manner. Development risk would decrease, the schedule confidence level would increase, and the possibility of a reduction in GSE requirements could be better explored. The depth of funding and the success achieved in the SRT development will affect the magnitude of development problems in Phase C/D and assure that the resulting concept is an optimum design.

2.6 ASSEMBLY LEVEL SCHEDULE INFORMATION

Supplemental schedule information is supplied by a Schedule Analysis Equipment List and Assessment Table 2-1. Equipment listings are by WBS breakout to the assembly level and, as nearly as possible, indicate: (1) technology assessment, (2) equipment/quantity/usage, (3) development time, and (4) schedule risk rating.

The tables have been structured to accept information from coincident tables, outputs, reports, engineering technologies, labs, procurement, program integration, etc. This has developed a coordinated source of data for project and subsystem schedule development, cost analysis funding requirements, test analysis equipment quantities and schedule/risk assessments.

SCHEDULE ANALYSIS EQUIPMENT LIST GLOSSAR'

Program = WBS Level 2

Project = WBS Level 3

System = WBS Level 4

Subsystem = WBS Level 5

Potential source = Vendor, Subcontractor or MDAC. * = Similar to noted Skylab part.

Technology Assessment

- Classification
  1. Aerospace
  2. Commercial
  3. Terrestrial Laboratory

- Technology Status
  1. Current
  2. Near-Term
  3. Advanced

- Development Status
  1. Available (use as is)
  2. Modification required
  3. New

- Complexity Level
  1. Low
  2. Average
  3. High (Complex)

COST ANALYSIS RATING - CROSS REFERENCE

1 to 10	State-of-the-art rating (Technology Rating)
11 to 300	
31 to 100	
5	Design Rating
3 & 4	
1 & 2	
1	Production Complexity Factor
2 & 3	
4 & 5	

Equipment Quantity/Usage

MU	Mockup
PVM	Project Verification Model
DT	Development Test
FDT	From Development Test to FM
FM	Functional Model
QT	Qualification Test
FQT	From Qualification Test to PVM
OV	Operational Vehicle
S	Spare

Note:

Equipment Quantity/Usages marked thus X__________X are the same as quantities used in 3.2 Thermal Control/Expendables and Control Subsystem

Development Schedule

Time in months - ER/AMO to delivery of non-qualification and flight quality units for development test and FM (DDT), and qualification test (DQT) respectively

ORIGINAL PAGE IS OF POOR QUALITY

Schedule Risk

Risk "A" - Estimating Conditions

1. There was sufficient time, data and definition available to authenticate most of the assumptions.
2. The accuracy of the estimates is questionable due to insufficient time, data or definition to substantiate the assumptions.
3. The estimate is highly uncertain due to very short reaction time and/or major problems of access to data and definition.

Risk "B" - Methods of Analysis and Data

1. Data was obtained by a well documented method and is from a reputable source.
2. A commonly used rule of thumb supported by data from standard sources was used to make the estimate.
3. A highly arbitrary rule of thumb supported by data which is highly suspect and very sparse in quantity was used to make the estimates.

Table 2-1 (Page 1 of 4)

SCHEDULE ANALYSIS EQUIPMENT LIST AND ASSESSMENT TABLE

Prog 2	Proj 3	System 4	Subsystem 5	Assembly/Component 6	7	Potential Source	Index	Technology Assessment: Classification	Technology Assessment: Technology	Technology Assessment: Development	Technology Assessment: Complexity	Equipment Quantity/Usage: Non-Operational MU	Non-Operational PVM	Non-Qual DT	Non-Qual FM	QT	Flight Quality FQT	Flight Quality PVM	S	OV	SIM	Dev Schedule: Non-Qualification (DDT)	Dev Schedule: Flight Quality (DQT)	Sch Risk A	Sch Risk B
PAYLOAD PROGRAMS	CLOUD PHYSICS EXPERIMENT LABORATORY PROJECT	1.0 Project Management					1																		
			0	Performance Management		MDAC	2																		
			0	Configuration Management			3																		
			0	Data Management			4																		
							5																		
		2.0 System Engineering and Integration	0	CPL/Spacelab Integration			6																		
			0	Cloud Physics Lab			7																		
			0	Experiment Support			8																		
			0	GSE			9																		
			0	Safety, Reliability and Quality Assurance		MDAC	10																		
							11																		
			3.1 Final Assembly Integration and Checkout				12																		
							13																		
							14																		
							15																		
							16																		
							17																		
				3.2 Thermal Control/Expendables and Control Subsystem			18					0.01	0.015	1 0	1.0	1.0	0.75	1.0	1.0	2.0	0.25	10.2	14.0	2	2
			3.2 Thermal Control/Expendables and Control	3.2.1	Integration, Assembly and Checkout	MDAC	19															2.0	3.0	2	2
				3.2.2	Thermal Control		20	1	2	3	3											8.0	10.5	2	2
				3.2.3	Flow, Humidity and Pressure Control		21		2	3	2											8.5	11.0	2	2
				3.2.4	Expendable Storage		22		1	3	3											8.2	11.0	2	2
				3.2.5	Instrumentation and Display Subassembly		23		1	3	1											7.8	10.0	2	2
				3.2.6	Expendables		24															6.8	9.2	2	2
				3.2.7	Cleansing Purge and Vent Subassembly		25		2	1												6.5	9.0	2	2
							26																		
							27																		
							28																		

Table 2-1 (Page 2 of 4)

SCHEDULE ANALYSIS EQUIPMENT LIST AND ASSESSMENT TABLE

Prog 2	Proj 3	System 4	Subsystem 5	Assembly/Component 6	7	Potential Source	Index	Technology Assessment: Classification	Technology	Development	Complexity	Equipment Quantity/Usage: Non-Operational MU	PVM	Non-Qual DT	FM	QT	Flight Quality FQT	PVM	S	OV	SIM	Dev Schedule: Non-Qualification (DDT)	Flight Quality (DQT)	Sch Risk A	B
PAYLOAD PROGRAMS	CLOUD PHYSICS EXPERIMENT LABORATORY PROJECT	3.0 Cloud Physics Experiment Laboratory					1																		
							2																		
			3.3 Particle Generator	3.3	Particle Generator Subsystem		3					(Same as 3.2 Subsystem)										12.0	15.0	2	2
				3.3.1	Integration, Assembly and Checkout	MDAC	4															2.0	3.0	2	2
				3.3.2	Wire Probe Retractor Generator		5		3	3	3											10.0	12.0	2	2
				3.3.3	Water Drop Impeller Generator		6		2	3	3											9.5	11.5	2	2
				3.3.4	Vibrating Orifice Generator		7		1	2	3											8.5	10.5	2	2
				3.3.5	Evaporator/Condenser Generator		8		2	3	3											9.5	11.2	2	2
				3.3.6	Spray Atomizer Generator		9		1	3	3											9.0	11.0	2	2
				3.3.7	Powder Dispersion Generator		10		1	3												8.2	10.3	2	2
				3.3.8	Particle Injector and Size Conditioner		11	2	3	3	2											10.0	13.0	2	2
				3.3.9	Instrumentation Displays		12		1	2	2											7.0	9.4	2	2
							13																		
							14																		
			3.4 Data Management	3.4	Data Management Subsystem		15					(Same as 3.2 Subsystem)										10.0	13.0	2	2
				3.4.1	Integration, Assembly and Checkout	MDAC	16															1.8	2.5	2	2
				3.4.2	Control Processor Assembly		17	1	1	3	1											8.2	10.5	2	2
				3.4.3	Tape Recorder Assy*	*Furnished by Spacelab or GFE	18																	2	2
				3.4.4	Master Control Assembly	MDAC	19	2	1	3	2											6.1	8.2	2	2
				3.4.5	Signal Conditioning Electronic Assembly	MDAC	20	1	1	2	1											6.7	8.7	2	2
				3.4.6	Instrumentation and Display Assembly	MDAC	21	2	1	3	2											6.1	8.3	2	2
				3.4.7	Expendables		22	2	1	3	2											5.0	6.0	2	2
				3.4.8	Cable Assemblies	MDAC	23															6.8	7.8	2	2
							24																		
							25																		
							26																		
							27																		
							28																		

Table 2-1 (Page 3 of 4)

SCHEDULE ANALYSIS EQUIPMENT LIST AND ASSESSMENT TABLE

Prog 2	Proj 3	System 4	Subsystem 5	Assembly/Component 6 7	Potential Source	Index	Technology Assessment: Classification	Technology Assessment: Technology	Technology Assessment: Development	Technology Assessment: Complexity	Equipment Quantity/Usage: Non-Operational MU	Non-Operational PVM	Non-Qual DT	FM	QT	FQT	Flight Quality PVM	S	OV	SIM	Dev Schedule: Non-Qualification (DDT)	Dev Schedule: Flight Quality (DQT)	Sch Risk A	Sch Risk B
PAYLOAD PROGRAMS	CLOUD PHYSICS EXPERIMENT LABORATORY PROJECT	3.0 Cloud Physics Experiment Laboratory				1																		
						2																		
			3.5 Particle Detector and Characterizer	3.5 Particle Detector Subsystem		3					(Same as 3.2 Subsystem)										11.5	15.5	2	2
				3.5.1 Integration, Assembly and Checkout	MDAC	4															2.0	3.0	2	2
				3.5.2 Optical Particle Counter		5	2	1	2	1											8.6	11.5	2	2
				3.5.3 Pulse Height Analyzer		6	2	1	2	1											7.3	9.5	2	2
				3.5.4 Condensation Nucleus Counter		7	2	1	2	2											8.0	11.0	2	2
				3.5.5 Microporous Filter		8	2	1	2	2											7.5	10.5	2	2
				3.5.6 Quartz Crystal Mass Monitor		9	2	2	2	2											7.8	10.2	2	2
				3.5.7 Cascase Impactor		10	2	2	1	2											7.3	10.1	2	2
				3.5.8 Electrical Aerosol Size Analyzer		11	2	1	1	3											8.5	11.5	2	2
				3.5.9 Scatterometer	Science Spectrum	12	2	3	3	2											7.0	11.0	2	2
				3.5.10 Liquid Water Content Meter		13	3	3	3	3											9.5	12.5	2	2
				3.5.11 Droplet Size Distribution Meter		14	3	3	3	3											9.3	11.8	2	2
				3.5.12 Optical Thermoelectric Dew Point Hygrometer		15	2	2	2	2											8.7	11.5	2	2
				3.5.13 Electric Dew Point Hygrometer		16	2	1	2	2											7.5	10.5	2	2
				3.5.14 Instrumentation/Displays		17															7.0	10.0	2	2
						18																		
						19																		
			3.6 Experiment Chambers and Aerosol Conditioning Assembly	3.6 Experiment Chambers & Aerosol Conditioning Subsystem		20					(Same as 3.2 Subsystem)										13.0	16.2	2	2
				3.6.1 Integration, Assembly and Checkout	MDAC	21															2.5	3.0	2	2
				3.6.2 Static Diffusion Liquid Chamber Assembly		22	3	3	3	3											10.5	13.0	2	2
				3.6.3 Static Diffusion Ice Chamber Assembly		23	2	1	3	2											10.3	12.3	2	2
				3.6.4 General Chamber Assembly		24	2	1	3	2											10.0	12.4	2	2
				3.6.5 Expansion Chamber Assembly		25	2	1	3	2											10.2	12.5	2	2
				3.6.6 Continuous Flow Diffusion Chamber Assembly		26	2	1	3	2											10.2	12.4	2	2
				3.6.7 Earth Simulation Chamber Assembly		27	3	3	3	3											10.5	13.0	2	2
				3.6.8 Nuclei Conditioning Assy		28	3	1	3	2											10.3	12.5	2	2

Table 2-1 (Page 4 of 4)

SCHEDULE ANALYSIS EQUIPMENT LIST AND ASSESSMENT TABLE

Prog 2	Proj 3	System 4	Subsystem 5	Assembly/Component 6 7	Potential Source	Index	Technology Assessment: Classification	Technology Assessment: Technology	Technology Assessment: Development	Technology Assessment: Complexity	Equipment Quantity/Usage: Non-Operational MU	Non-Operational PVM	Non-Qual DT	Non-Qual FM	Non-Qual QT	FQT	Flight Quality PVM	Flight Quality S	OV	SIM	Non-Qualification (DDT)	Flight Quality (DQT)	Sch Risk A	Sch Risk B
PAYLOAD PROGRAMS	CLOUD PHYSICS EXPERIMENT LABORATORY PROJECT	3.0 Cloud Physics Experiment Laboratory				1																		
						2																		
			3.7 Console	3.7 Console Subsystem		3					(Same as 3.2 Subsystem)										9.5	13.5	2	2
				3.7.1 Integration, Assembly and Checkout	MDAC	4															2.0	3.0	2	2
				3.7.2 Console Support Structure and Subassembly		5	1	1	2	1											7.0	10.0	2	2
				3.7.3 Power Control and Distribution		6	2	1	3	2											7.5	10.5	2	2
				3.7.4 Console Panels and Drawer Subassembly		7	1	1	3	1											6.5	9.5	2	2
				3.7.5 Overhead Storage Subassembly	Furnished by Spacelab	8															X	X	2	2
				3.7.6 Floor Segment Subassembly	Furnished by Spacelab	9															X	X	2	2
				3.7.7 Instrumentation/ Displays	Included in Other Systems	10															X	X	2	2
						11																		
						12																		
			3.8 Optical and Imaging Devices	3.8 Optical and Imaging Subsystem		13					(Same as 3.2 Subsystem)										9.0	14.0	2	2
				3.8.1 Integration, Assembly and Checkout	MDAC	14															2.0	3.0	2	2
				3.8.2 Cine Camera (35 mm)	Goetel Inc. Multi-Data Camera	15	2	1	2	2											6.0	9.5	2	2
				3.8.3 Still Camera (35 mm)	Nikon Photomic 1564	16	2	1	2	2											6.0	9.5	2	2
				3.8.4 Microscope Trinocular	American Optical Micro Star	17	2	1	2	2											6.0	9.5	2	2
				3.8.5 Video Camera Assembly (16 mm)	Cohu 4300	18	2	1	2	2											6.0	9.5	2	2
				3.8.6 Light Source	NASA (?)	19	3	1	2	2											6.0	10.0	2	2
				3.8.7 Anenometer	Thermo Systems Inc 972	20	2	1	2	2											6.0	9.5	2	2
				3.8.8 Stereo Microscope	Bausch & Lomb	21	2	3	2	2											6.8	10.5	2	2
				3.8.9 Scatterometer		22	2	3	2	2											6.8	10.5	2	2
				3.8.10 IR Microscope	Barnes Eng Co.	23	2	3	2	2											6.8	10.5	2	2
				3.8.11 Support Equipment/ Expendables		24	3	3	3	1											7.0	10.8	2	2
				3.8.12 Displays/Controls		25	2	1	3	1											6.5	10.4	2	2

Section 3
COSTS AND FUNDING

Contained herein are the data comprising the final cost analysis documentation as follows: (1) summary of the cost analysis approach and methodology, (2) cost analysis ground rules and assumptions, (3) total project and subsystem cost summary tables, and (4) formal documentation of the cost analysis results displayed on the cost model summary forms and the NASA data forms A(1), A(2), A(3), B and C.

3.1 COST ANALYSIS APPROACH AND METHODOLOGY

The approach employed in performing the cost analysis effort emphasized close coordination between the cost analysts and the technical and schedules analysis personnel assigned to the study. The use of this approach provided a viable means to incorporate cost revisions and updates as the system design, operational definitions, and schedules philosophy evolved during the course of the study. The methodology used to estimate DDT&E, Production and Operations costs is documented in detail in the study bulletins listed in the bibliography. The key element in the cost methodology is the establishment of a firm production cost base reflecting unit costs of major components provided by potential suppliers of component hardware. In most cases, costs were estimated at a level of detail two levels below the reporting level so that considerable backup analysis exists to support the costs reported on the data forms. The use of a closely coordinated approach in the application of a comprehensive cost methodology has resulted in cost and funding estimates which reflect a high degree of confidence, both in relation to the current project phase and in forecasting that variations in cost estimates will remain within acceptable limits as the project progresses through later phases.

3.2 COST ANALYSIS GROUND RULES AND ASSUMPTIONS

The following cost analysis ground rules and assumptions were used in estimating Production and DDT&E costs of CPL subsystems, assemblies, sub-assemblies and components.

A. Production Costs

1. Adjustment No. 1 to T1 (first unit) cost
   a. Inflation to 1973 dollars from previous years at 6 percent per year compounded annually.
   b. Inflation from 1973 to 1974 dollars at 7 percent.
2. Adjustments No. 2 to T1 cost
   a. Ratio of cost from commercial hardware to space-qualified hardware - determined for each item in consultation with subsystem engineer.
3. Assume prices quoted for commercial hardware items are average unit (Ta) prices for the quantity of units specified by the subsystem engineer. A theoretical T1 cost will be established from the Ta price using a 95 percent cost reduction curve (straight line, cumulative average curve).
4. If a hardware item has been flown in space, the cost will be brought down a 95 percent cost reduction curve from the T1 to a unit (Tu) representing the quantity flown on prior programs. This Tu will become the T1 for the CPL.
5. The number of units used in calculating Production cost is the total number required for two (2) CPL flight articles. On the Worksheet, a number in parenthesis will be used to indicate the reference unit on a cost reduction curve (CRC) for each component/assembly.
6. Production costs will be computed from the adjusted T1 value using a 95 percent CRC. Common usage items will be carried down the curve in relation to respective reference unit numbers.
7. Integration, Assembly and Checkout will be calculated an appropriate percentage of the sum of the constituent hardware costs at each WBS level, where applicable. This percentage varies from 8 percent for subassemblies and components which require little further assembly after receipt by the prime

contractor to 100 percent for items which require considerable effort to integrate and assemble into a complete subsystem.

8. Spares cost will be calculated at the subsystem level (WBS Level 5) for each CPL subsystem. It is assumed that WBS 3.7.2 and 3.7.4 - Support Structure and Panels and Drawers of the Console Subsystem (WBS 3.7) will not require any spares. For all subsystems and subsystem elements, spares are assumed to be equivalent to 50 percent of the hardware cost for two CPL's over the 10-years of Operational Flight. Of this 50 percent, 5 percent will be allocated to production cost to cover initial spares, and 45 percent will be charged to Operations to cover recurring spares. The percentages will be applied to the unit following the 2-flight units (Tu3). Tu3 will be computed from a calculated T1 derived from the total production cost (Tc2) for each subsystem.

B. DDT&E Costs

1. Basic Engineering Design and Development (ED&D) is assumed to be equivalent to the effort required to bring commercial or laboratory type hardware up to MIL-STD reliability equivalency prior to Production. For items not previously space-qualified, a ratio to T1 of 2.0 will be assumed. For space-qualified items, a ratio of T1 of 1.0 (no addition) will be assumed.
2. Design Rating and Technology Rating as provided by the subsystem engineers for each item, will be applied to the basic ED&D cost to account for the redesign/development technology uprating effort required to adapt the item for use in space.
3. Integration, Assembly and Checkout will be calculated at an appropriate percentage of the sum of the constituent hardware costs at each WBS level, where applicable, for both ED&D and Ground Test Hardware (GTH). An artificial (calculated) base will be used in order to cover this effort, where common items are included in more than one assembly. The percentage applied to ED&D varies from 8 percent for items requiring nominal non-recurring integration effort to 75 percent for items requiring considerable design effort for installation and integration into a complete subsystem.

4. Pending further definition GTH, at and below the subsystem level, will be assumed to include the equivalent of four units, two for development test and two for qualification test. GTH will be calculated at four times T1 cost with no learning (100-percent CRC). As soon as feasible during the development and qualification testing effort, one equivalent set of surviving development test hardware will be diverted for assembly into the Functional Model (FM) for use in System Development Testing and to remain at the factory for use in design change control. One equivalent set of qualification test hardware will be diverted for assembly into the Project Verification Model (PVM) for use in System Verification Testing. Upon completion of testing effort at the factory, the PVM will be shipped to the Experiment Control Center (ECC) for use as a Simulator. The second set of qualification test hardware, with an allowance for replacement of 25 percent of the hardware destroyed in test, will be assembled and shipped to the launch site for use as the second simulator.
5. It is assumed that no flight test hardware (FTH) will be required at or below the subsystem level.

3.3 COST SUMMARY TABLES

Table 3-1 presents a summary of total Cloud Physics Laboratory project costs by phase and by system level cost element. This table shows an estimated total project cost of approximately $45 million which included $21 million for DDT&E cost, $7 million for the production of 2 flight articles, and an average of $400 thousand per flight for 42 operational missions.

Table 3-2 presents a summary of the Cloud Physics Laboratory System costs by phase and by subsystem level cost element. This table shows that the Laboratory System accounts for approximately $25 million of the $45 million total project cost and also provides visibility on the distribution of costs among the Laboratory subsystems.

Table 3-1

ZERO GRAVITY CLOUD PHYSICS LABORATORY PROJECT

Cost Summary
1974 Dollars in Millions

WBS	Description	Costs of Millions of 1974 Dollars			
		DDT&E	Production	Operations	Total
1.0	Project Management	0.550	0.273	0.449	1.272
2.0	System Engineering and Integration	1.386	0.589	0.634	2.609
3.0	Cloud Physics Experiment Laboratory	16.644	5.961	2.814	25.419
4.0	Experiment Support Hardware	0	0	0	0
5.0	System Test	0.558	0	0	0.558
6.0	Ground Support Equipment	1.233	0.054	0.595	1.882
7.0	Facilities	0	0	0	0
8.0	Logistics	0.962	0.005	0.161	1.128
9.0	Ground Operations	0	0	5.154	5.154
10.0	Flight Operations	0	0	0.122	0.122
11.0	Principal Investigator Operations	0	0	6.803	6.803
	Total	21.333	6.882	16.732	44.947

Table 3-3 presents a comparison of the current (September, 1974) cost estimates with the previous (September, 1973) cost estimates for the Cloud Physics Laboratory project. The 1973 costs have been adjusted to 1974 dollars and then compared with the 1974 estimates at the total project level, the CPL system level, and in terms of average operational cost per flight. The total project cost, normalized to 1974 dollars, shows an increase of \$13.3 million or 42 percent from 1973 to 1974. However, most of this increase is due to a change in the operational program from 15 flights in 1973 to 42 flights in 1974. If the 1974 cost is normalized to 15 flights, the

Table 3-2

ZERO GRAVITY CLOUD PHYSICS LABORATORY SYSTEM

Cost Summary

WBS	Description	Costs in Millions of 1974 Dollars			
		DDT&E	Production	Operations	Total
3.0	Cloud Physics Experiment Laboratory	16.644	5.961	2.814	25.419
3.1	Final Assembly, Integration and Checkout	0.793	0.273	0	1.066
3.2	Thermal Control/ Expendables Storage and Control	2.501	0.864	0.969	4.334
3.3	Particle Generators	1.391	0.357	0.140	1.888
3.4	Data Management	2.662	0.791	0.352	3.805
3.5	Particle Detectors and Characterizers	2.506	0.774	0.304	3.584
3.6	Experiment Chambers	2.693	1.492	0.585	4.770
3.7	Console	1.711	0.792	0.053	2.556
3.8	Optical Detection and Imaging Devices	2.387	0.618	0.411	3.416

cost increase from 1973 to 1974 is only \$2.6 million or 8.2 percent which can be justified as acceptable growth due to better definition. It can reasonably be expected that the rate of cost growth through later phases of project definition should remain close to this 8 percent level and that the total project cost will remain within acceptable budgetary restraints.

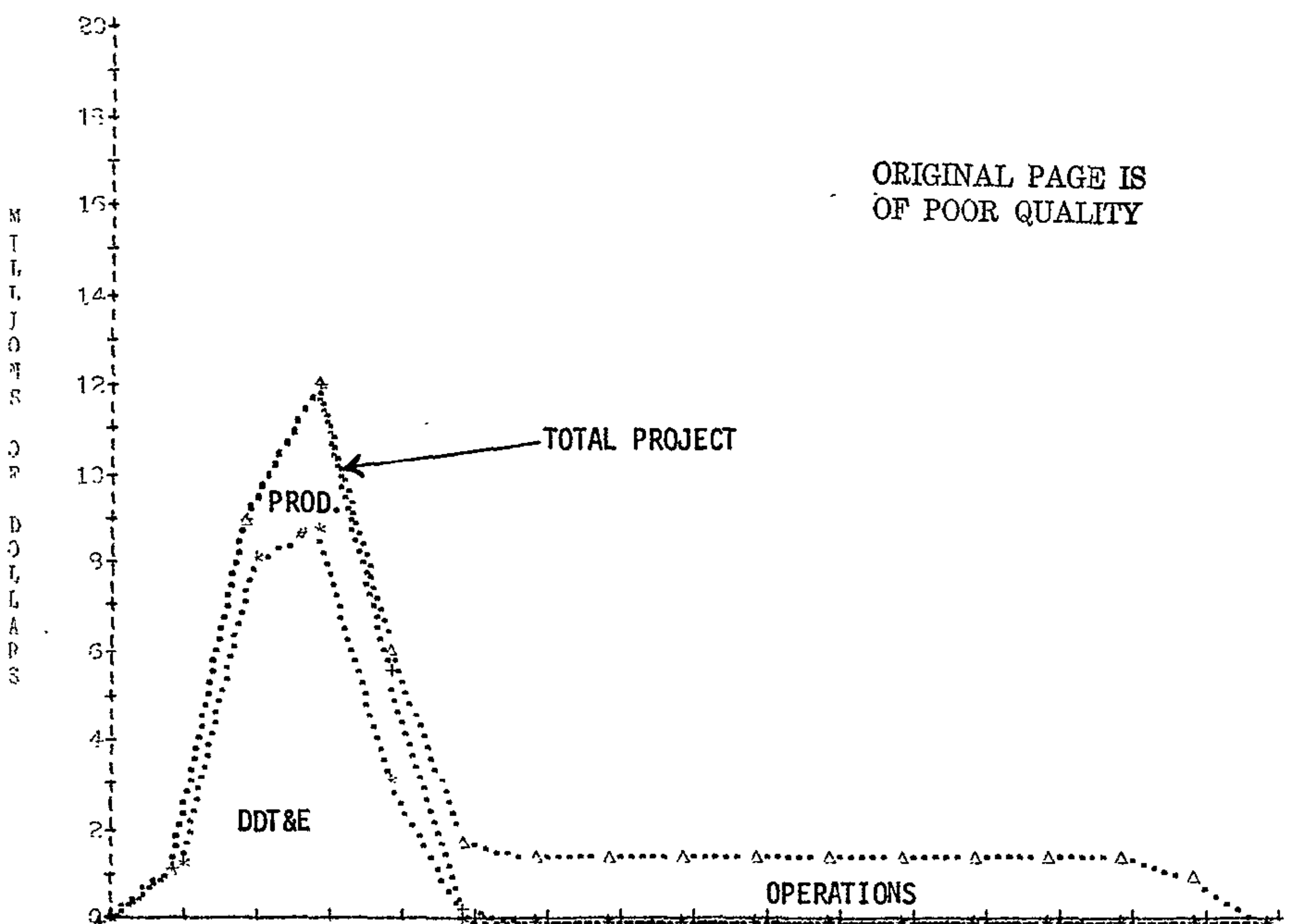
Figure 3-1 presents the distribution of annual funding requirements for the total Cloud Physics Laboratory project in accordance with the presently defined schedule. The NASA requirement to deliver the first flight article 36 months from ATP results in a rapid funding buildup in both DDT&E and Production with peak annual funding of \$12.2 million occurring in fiscal

Table 3-3

ZERO GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY

Comparison of 9/74 and 9/73 Cost Estimates
Costs in Millions of Dollars

WBS No.	Description	9/73 \$ 73	9/73 Adj. to \$ 74 at 1.07)	9/74 \$ 74	Δ and Remarks
3.0	CPL System - DDT&E	\$14.7	\$15.7	\$16.6	+\$0.9, + 5.7% = better definition
3.0	CPL System - Production	3.5	3.7	6.0	+ \$2.3, + 62% = better definition
	Operations - Cost per Flight	0.500 (15 Flights)	0.535	0.399 (42 Flights)	- \$0.136, - 25% = better definition
	Total Project - DDT&E	17.9	19.2	21.3	+\$2.1, + 11% = better definition
	Total Project - Production	4.1	4.4	6.9	+\$2.5, + 57% = better definition
	Total Project - Operations	7.5 (15 Flights)	8.0 (15 Flights)	16.7 (42 Flights)	+ \$8.7, + 209% = 27 more flights at 25% less cost per flight = better definition
	Total Project Cost	29.5	31.6	44.9	+ \$13.3, + 42%
	Total Project Cost Normalized to 15 Flights	29.5	31.6	34.2	+\$2.6, + 8.2% growth due to better definition



GFY	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
DDT&E	1.2	8.1	6.8	3.2	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROD	.0	1.0	5.3	2.4	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OPER	.0	.0	.1	.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.1	.0
TOTAL	1.2	9.1	12.2	6.1	1.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.1	.0

Figure 3-1. Zero-Gravity Atmospheric Cloud Physics Experiment Laboratory Annual Funding
(1974 Dollars in Millions)

year 1979. Should the 36 months be relaxed to 42 or 46 months, a significant reduction in peak annual funding can be expected, and the peak year can be expected to shift from fiscal year 1979 to fiscal year 1980.

3.4 COST MODEL SUMMARY DATA (MDAC FORMAT)

This subsection presents, on the MDAC Cost Model Summary format, the total Cloud Physics Laboratory project cost estimates by project phase and at the WBS levels indicated in Table 1-1 of the Work Breakdown Structure dictionary.

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
1.0	PROJECT MANAGEMENT	3				549.6				272.6			449.2	1,271.4
2.0	SYSTEM ENGINEERING AND INTEGRATION	3				1,386.0				589.1			633.6	2,608.7
3.0	CLOUD PHYSICS EXPERIMENT LABORATORY	3	8,582.2	8,062.1		16,644.3	3,021.7	5,741.4	219.3	5,960.7	840.0	1,973.8	2,813.8	25,418.8
4.0	EXPERIMENT SUPPORT HARDWARE	3				0				0			0	0
5.0	SYSTEM TEST	3				557.8				0			0	557.8
6.0	GROUND SUPPORT EQUIPMENT (GSE)	3				1,232.9				54.1			595.0	1,882.0
7.0	FACILITIES	3				0				0			0	0
8.0	LOGISTICS	3				961.6				5.0			160.9	1,127.5
9.0	GROUND OPERATIONS	3				0				0			5,153.6	5,153.6
10.0	FLIGHT OPERATIONS	3				0				0			122.3	122.3
11.0	PRINCIPAL INVESTIGATOR OPERATIONS	3				0				0			6,803.5	6,803.5
	TOTAL	3				21,332.2				6,881.5			16,731.9	44,945.6

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS SPRS.	TOTAL OPER.	TOTAL PROJ.
2.0	SYSTEM ENGINEERING AND INTEGRATION	3												
2.1	CPL/SPACELAB INTEGRATION	3				554.4				235.7			253.4	1043.5
2.2	CLOUD PHYSICS LABORATORY	3				415.8				176.7			190.0	782.5
2.3	EXPERIMENT SUPPORT	3				138.6				58.9			63.4	260.9
2.4	GROUND SUPPORT EQUIPMENT	3				138.6				58.9			63.4	260.9
2.5	SAFETY, RELIABILITY AND QUALITY ASSURANCE	3				138.6				58.9			63.4	260.9
	TOTAL	3				1386.0				589.1			633.6	2608.7

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.0	CLOUD PHYSICS EXPERIMENT LABORATORY	3												
3.1	FINAL ASSEMBLY, INTEGRATION AND CHECKOUT	3	408.7	383.9		792.6	143.9	273.4	0	273.4			0	1066.0
3.2	THERMAL CONTROL/EXPENDABLES STORAGE													
	AND CONTROL	3	1381.8	1119.7		2501.5	434.4	825.9	37.7	863.6	630.0	338.8	968.8	4333.9
3.3	PARTICLE GENERATORS	3	887.4	504.0		1391.4	179.7	341.2	15.6	356.8		140.0	140.0	1888.2
3.4	DATA MANAGEMENT	3	1327.3	1334.7		2662.0	398.4	756.8	34.5	791.3	42.0	310.4	352.4	3805.7
3.5	PARTICLE DETECTORS AND CHARACTERIZERS	3	1154.9	1350.7		2505.6	389.7	740.1	33.7	773.8		303.6	303.6	3583.0
3.6	EXPERIMENT CHAMBERS	3	1678.5	1014.2		2692.7	750.9	1426.8	65.0	1491.8		585.3	585.3	4769.8
3.7	CONSOLE	3	579.1	1132.0		1711.1	413.6	786.0	5.9	791.9		53.2	53.2	2556.2
3.8	OPTICAL DETECTION AND IMAGING DEVICES	3	1164.5	1222.9		2387.4	311.1	591.2	26.9	618.1	168.0	242.5	410.5	3416.0
	TOTAL	3	8582.2	8062.1		16,644.3	3021.7	5741.4	219.3	5960.7	840.0	1973.8	2813.8	25,418.8

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.2	THERMAL CONTROL/EXPENDABLES STORAGE													
	AND CONTROL	3												
3.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	102.4	82.9		185.3	32.2	61.2		61.2				246.5
3.2.2	THERMAL CONTROL	3	454.6	515.7		970.3	128.9	244.9		244.9				1215.2
3.2.3	FLOW, HUMIDITY, AND PRESSURE CONTROL	3	621.2	298.5		919.7	74.6	141.8		141.8				1061.5
3.2.4	EXPENDABLES STORAGE	3	79.0	142.2		221.2	71.5	135.9		135.9				357.1
3.2.5	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	5.5	16.6		22.1	107.6	204.9		204.9				227.0
3.2.6	EXPENDABLES	3	0	0		0	0	0		0	630.0		630.0	630.0
3.2.7	CLEANSING, PURGE, AND VENT SUBASSEMBLY	3	119.1	63.8		182.9	19.6	37.2		37.2				220.1
	INITIAL SPARES	3							37.7	37.7				37.7
	OPERATIONAL SPARES	3										338.8	338.8	338.8
	TOTAL	3	1381.8	1119.7		2501.5	434.4	825.9	37.7	863.6	630.0	338.8	968.8	4333.9

FOLDOUT FRAME

1

FOLDOUT FRAME

2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.2.2	THERMAL CONTROL	3												
3.2.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	33.7	38.2		71.9	9.5	18.1		18.1			0	90.0
3.2.2.2	CLOUD CHAMBER COOLING SUBASSEMBLY CFD, SDI E	3	368.8	456.9		825.7	114.2	217.0		217.0			0	1042.7
3.2.2.3	SUPPORT EQUIPMENT COOLING SUBASSEMBLY	3	52.1	20.6		72.7	5.2	9.8		9.8			0	82.5
	TOTAL	3	454.6	515.7		970.3	128.9	244.9		244.9			0	1215.2
3.2.3	FLOW, HUMIDITY, AND PRESSURE CONTROL	3												
3.2.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	46.0	22.1		68.1	5.5	10.5		10.5			0	78.6
3.2.3.2	HUMIDIFICATION SUBASSEMBLY SDI E	3	386.1	185.0		571.1	46.3	87.9		87.9			0	659.0
3.2.3.3	WATER STORAGE AND SUPPLY SUBASSEMBLY ALL	3	189.1	91.4		280.5	22.8	43.4		43.4			0	323.9
	TOTAL	3	621.2	298.5		919.7	74.6	141.8		141.8			0	1061.5
3.2.4	EXPENDABLES STORAGE	3												
3.2.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	13.7	10.5		24.2	5.3	10.1		10.1			0	34.3
3.2.4.2	DRY AIR STORAGE SUBASSEMBLY	3	19.5	90.7		110.2	37.8	71.8		71.8			0	182.0
3.2.4.3	SAMPLE GAS STORAGE SUBASSEMBLY	3	45.8	41.0		86.8	28.4	54.0		54.0			0	140.8
	TOTAL	3	79.0	142.2		221.2	71.5	135.9		135.9			0	357.1
3.2.5	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3												
3.2.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	0.4	1.2		1.6	8.0	15.2		15.2			0	16.8
3.2.5.2	TEMPERATURE SENSORS	3	0.7	2.1		2.8	12.9	24.6		24.6			0	27.4
3.2.5.3	PRESSURE SENSORS	3	4.4	13.3		17.7	86.9	165.1		165.1			0	182.8
3.2.5.4	VISUAL DISPLAYS (NOT INCLUDED HERE)	3	0	0		0	0	0		0			0	0
	TOTAL	3	5.5	16.6		22.1	107.6	204.9		204.9			0	227.0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.2.6	EXPENDABLES	3												
3.2.6.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3				0	0	0		0				
3.2.6.2	AIR	3				0	0	0		0				
3.2.6.3	SAMPLE GASES	3				0	0	0		0				
3.2.6.4	WATER	3				0	0	0		0				
	TOTAL	3				0	0	0		0	630.0		630.0	630.0
3.2.7	CLEANSING, PURGE, AND VENT SUBASSEMBLY	3												
3.2.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	11.0	4.7		15.7	1.5	2.8		2.8			0	18.5
3.2.7.2	VALVES	3	0	18.0		18.0	7.8	14.9		14.9			0	32.9
3.2.7.3	FILTERS	3	50.2	18.1		68.3	4.5	8.6		8.6			0	76.9
3.2.7.4	DISTRIBUTION PLUMBING	3	57.9	23.0		80.9	5.7	10.9		10.9			0	91.8
	TOTAL	3	119.1	63.8		182.9	19.6	37.2		37.2			0	220.1

FOLDOUT FRAME

FOLDOUT FRAME

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.3	PARTICLE GENERATORS	3												
3.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	135.4	37.3		172.7	13.3	25.3		25.3				198.0
3.3.2	WIRE PROBE RETRACTOR GENERATOR SDI	3	186.0	86.4		272.4	20.3	38.6		38.6				311.0
3.3.3	WATER DROP IMPELLER GENERATOR	3	48.8	24.2		73.0	6.8	12.9		12.9				85.9
3.3.4	VIBRATING ORIFICE GENERATOR	3	113.5	160.4		273.9	41.9	79.6		79.6				353.5
3.3.5	EVAPORATOR/CONDENSER GENERATOR CFDE	3	52.1	39.6		91.7	17.4	33.0		33.0				124.7
3.3.6	SPRAY ATOMIZER GENERATOR	3	22.1	23.5		45.6	8.3	15.7		15.7				61.3
3.3.7	POWDER DISPERSION GENERATOR	3	51.4	18.7		70.1	6.1	11.5		11.5				81.6
3.3.8	PARTICLE INJECTOR AND SIZE CONDITIONER	3	253.7	84.5		338.2	55.3	105.1		105.1				443.3
3.3.9	INSTRUMENTATION/DISPLAYS	3	24.4	29.4		53.8	10.3	19.5		19.5				73.3
	INITIAL SPARES	3							15.6	15.6				15.6
	OPERATIONAL SPARES	3										140.0	140.0	140.0
	TOTAL	3	887.4	504.0		1391.4	179.7	341.2	15.6	356.8		140.0	140.0	1888.2

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.3.2	WIRE PROBE RETRACTOR GENERATOR	3												
3.3.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	13.8	6.4		20.2	0.3	0.6		0.6				20.8
3.3.2.2	DUAL PULSE GENERATOR	3	115.1	53.5		168.6	13.4	25.4		25.4				194.0
3.3.2.3	SWITCH	3	0.1	0.2		0.3	0.1	0.1		0.1				0.4
3.3.2.4	HIGH VOLTAGE PULSE GENERATOR	3	36.4	17.0		53.4	4.3	8.1		8.1				61.5
3.3.2.5	LINEAR ACTUATOR	3	4.7	4.6		9.3	1.2	2.2		2.2				11.5
3.3.2.6	WIRE PROBE RETRACTOR	3	14.5	2.0		16.5	0.5	0.9		0.9				17.4
3.3.2.7	VALVE	3	1.4	2.7		4.1	0.7	1.3		1.3				5.4
	TOTAL	3	186.0	86.4		272.4	20.5	38.6		38.6				311.0
3.3.3	WATER DROP IMPELLER GENERATOR	3												
3.3.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	4.1	1.8		5.9	0.5	1.0		1.0				6.9
3.3.3.2	HIGH VOLTAGE PULSE GENERATOR	3	36.4	16.9		53.3	4.2	8.0		8.0				61.3
3.3.3.3	SWITCH	3	0	0.1		0.1	0.1	0.1		0.1				0.2
3.3.3.4	SOLENOID DRIVER	3	0	2.6		2.6	1.1	2.0		2.0				4.6
3.3.3.5	WATER DROP IMPELLER	3	8.3	1.4		9.7	0.3	0.6		0.6				10.3
3.3.3.6	VALVE	3	0	1.4		1.4	0.6	1.2		1.2				2.6
	TOTAL	3	48.8	24.2		73.0	6.8	12.9		12.9				85.9
3.3.4	VIBRATING ORIFICE GENERATOR	3												
3.3.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	8.6	12.1		20.7	3.1	5.9		5.9				26.6
3.3.4.2	FREQUENCY GENERATOR	3	20.5	30.1		50.6	7.5	14.3		14.3				64.9
3.3.4.3	POSITIVE DISPLACEMENT PUMP	3	4.2	6.4		10.6	1.6	3.0		3.0				13.6
3.3.4.4	VIBRATING ORIFICE	3	68.9	100.8		169.7	25.2	47.9		47.9				217.6
3.3.4.5	VALVE	3	0	0		0	1.7	3.3		3.3				3.3
3.3.4.6	FLOW CONTROLLER	3	11.3	11.0		22.3	2.7	5.2		5.2				27.5
	TOTAL	3	113.5	160.4		273.9	41.8	79.6		79.6				353.5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.3.5	EVAPORATOR/CONDENSER GENERATOR	3												
3.3.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	4.8	2.9		7.7	1.3	2.4		2.4				10.1
3.3.5.2	EVAPORATOR FURNACE	3	35.7	15.1		50.8	7.2	13.6		13.6				64.4
3.3.5.3	CONDENSER	3	9.5	9.0		18.5	4.3	8.2		8.2				26.7
3.3.5.4	THERMAL CONTROLLER	3	2.1	4.2		6.3	1.1	2.0		2.0				8.3
3.3.5.5	FLOW CONTROLLER	3	0	4.3		4.3	1.9	3.7		3.7				8.0
3.3.5.6	VALVE	3	0	4.1		4.1	1.6	3.1		3.1				7.2
	TOTAL	3	52.1	39.6		91.7	17.4	33.0		33.0				124.7
3.3.6	SPRAY ATOMIZER GENERATOR	3												
3.3.6.1.	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	2.9	1.7		4.6	0.6	1.2		1.2				5.8
3.3.6.2	POSITIVE DISPLACEMENT PUMP	3	0	3.1		3.1	1.4	2.7		2.7				5.8
3.3.6.3	SPRAY ATOMIZER	3	19.2	8.9		28.1	2.2	4.2		4.2				32.3
3.3.6.4	FLOW CONTROLLER	3	0	4.3		4.3	1.8	3.5		3.5				7.8
3.3.6.5	VALVE	3	0	5.5		5.5	2.2	4.1		4.1				9.6
	TOTAL	3	22.1	23.5		45.6	8.2	15.7		15.7				61.3
3.3.7	POWDER DISPERSION GENERATOR	3												
3.3.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	4.7	1.4		6.1	0.5	0.9		0.9				7.0
3.3.7.2	POWDER DISPERSER	3	46.7	8.9		55.6	2.2	4.2		4.2				59.8
3.3.7.3	FLOW CONTROLLER	3	0	4.3		4.3	1.8	3.4		3.4				7.7
3.3.7.4	VALVE	3	0	4.1		4.1	1.6	3.0		3.0				7.1
	TOTAL	3	51.4	18.7		70.1	6.1	11.5		11.5				81.6
	FOLDOUT FRAME 1											FOLDOUT FRAME 2		

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.3.8	PARTICLE INJECTOR AND SIZE CONDITIONER	3												
3.3.8.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	142.8	6.5		149.3	27.7	52.6		52.6				201.9
3.3.8.2	CONDITIONER WALL SUBASSEMBLY	3	0	34.0		34.0	13.2	25.1		25.1				59.1
3.3.8.3	OPTICAL PORTS	3	0	0.2		0.2	0.1	0.1		0.1				0.3
3.3.8.4	EQUIPMENT MOUNTING PORTS	3	0	4.0		4.0	1.5	2.8		2.8				6.8
3.3.8.5	WATER WICKING SURFACE	3	0	0.2		0.2	0.1	0.2		0.2				0.4
3.3.8.6	ACOUSTICAL SUBASSEMBLY	3	0	9.0		9.0	3.4	6.5		6.5				15.5
3.3.8.7	THERMAL CONTROLLER	3	0	4.2		4.2	1.6	3.1		3.1				7.3
3.3.8.8	VELOCITY CONTROLLER	3	108.8	16.0		124.8	4.0	7.6		7.6				132.4
3.3.8.9	SHUTTER VALVE	3	1.7	1.6		3.3	0.4	0.8		0.8				4.1
3.3.8.10	VALVES	3	0	1.3		1.3	0.5	0.9		0.9				2.2
3.3.8.11	INSTRUMENTATION AND DISPLAY	3	0.4	7.5		7.9	2.8	5.4		5.4				13.3
	TOTAL	3	253.7	84.5		338.2	55.3	105.1		105.1				443.3
3.3.9	INSTRUMENTATION/DISPLAYS	3												
3.3.9.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	1.8	2.2		4.0	0.8	1.5		1.5				5.5
3.3.9.2	VOLTAGE SENSORS	3	6.4	9.5		15.9	2.4	4.5		4.5				20.4
3.3.9.3	TEMPERATURE SENSORS	3	0.2	0.4		0.6	0.4	0.7		0.7				1.3
3.3.9.4	AIR FLOW SENSORS	3	1.9	2.9		4.8	3.2	6.0		6.0				10.8
3.3.9.5	POSITION SENSORS	3	2.3	2.1		4.4	0.5	1.0		1.0				5.4
3.3.9.6	FREQUENCY SENSORS	3	10.2	10.0		20.2	2.5	4.7		4.7				24.9
3.3.9.7	DISPLAYS	3	1.6	2.3		3.9	0.6	1.1		1.1				5.0
	TOTAL	3	24.4	29.4		53.8	10.4	19.5		19.5				73.3

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.4	DATA MANAGEMENT	3												
3.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	98.3	98.9		197.2	29.5	56.0		56.0				253.2
3.4.2	CONTROL PROCESSOR ASSEMBLY	3	401.2	340.7		741.9	96.9	184.0		184.0				925.9
3.4.3	TAPE RECORDER ASSEMBLY	3	0	0		0	0	0		0				0
3.4.4	MASTER CONTROL ASSEMBLY	3	143.5	59.8		203.3	14.9	28.4		28.4				231.7
3.4.5	SIGNAL CONDITIONING ELECTRONICS ASSEMBLY	3	391.7	516.4		908.1	129.2	245.3		245.3				1153.4
3.4.6	INSTRUMENTATION AND DISPLAY ASSEMBLY	3	274.9	311.9		586.8	94.7	180.0		180.0				766.8
3.4.7	EXPENDABLES	3	0	0		0	0	0		0	42.0		42.0	42.0
3.4.8	CABLE ASSEMBLIES	3	17.7	7.0		24.7	33.2	63.1		63.1				87.8
	INITIAL SPARES	3							34.5	34.5				34.5
	OPERATIONAL SPARES	3										310.4	310.4	310.4
	TOTAL	3	1327.3	1334.7		2662.0	398.4	756.8	34.5	791.3	42.0	310.4	352.4	3805.7

FOLDOUT FRAME 1

FOLDOUT FRAME 2

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	1.415 ED&D	1 x 1.415 GTH	FTH	TOTAL DDT&E	MEMO T_1 1.310	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.4.2	CONTROL PROCESSOR ASSEMBLY	3												
3.4.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT		29.7	25.2		54.9	7.2	13.6		13.6				68.5
3.4.2.2	CONTROL PROCESSOR	3	180.0	267.6		447.6	66.9	127.1		127.1				574.7
3.4.2.3	SOFTWARE	3	70.5	0		70.5	0	0		0				70.5
3.4.2.4	CONTROL UNITS	3	121.0	47.9		168.9	22.8	43.3		43.3				212.2
	TOTAL	3	401.2	340.7		741.9	96.9	184.0		184.0				925.9
3.4.4	MASTER CONTROL ASSEMBLY	3												
3.4.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	10.7	4.4		15.1	1.1	2.1		2.1				17.2
3.4.4.2	KEYBOARD	3	1.7	3.4		5.1	0.8	1.6		1.6				6.7
3.4.4.3	DISCRETE CONTROLS	3	131.1	52.0		183.1	13.0	24.7		24.7				207.8
	TOTAL	3	143.5	59.8		203.3	14.9	28.4		28.4				231.7
3.4.5	SIGNAL CONDITIONING ELECTRONICS ASSEMBLY	3												
3.4.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	29.0	38.2		67.2	9.6	18.2		18.2				85.4
3.4.5.2	ANALOG CONDITIONING ELECTRONICS	3	116.7	46.3		163.0	11.6	22.0		22.0				185.0
3.4.5.3	DIGITAL CONDITIONING ELECTRONICS	3	116.7	46.3		163.0	11.6	22.0		22.0				185.0
3.4.5.4	FORMATTER	3	127.9	382.8		510.7	95.7	181.8		181.8				692.5
3.4.5.5	RAU	3	0	0		0	0	0		0				0
3.4.5.6	INTERCOM	3	1.4	2.8		4.2	0.7	1.3		1.3				5.5
3.4.5.7	CAUTION/WARNING ELECTRONICS	3	0	0		0	0	0		0				0
	TOTAL	3	391.7	516.4		908.1	129.2	245.3		245.3				1153.4

FOLDOUT FRAME 1

FOLDOUT FRAME 2

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.4.6	INSTRUMENTATION AND DISPLAY ASSEMBLY	3												
3.4.6.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	20.4	23.1		43.5	7.0	13.4		13.4				56.9
3.4.6.2	INSTRUMENTATION	3	10.7	6.6		17.3	16.3	31.0		31.0				48.3
3.4.6.3	VIDEO MONITOR	3	2.8	5.7		8.5	1.4	2.7		2.7				11.2
3.4.6.4	GRAPHICS DISPLAY UNIT	3	106.8	213.5		320.3	53.4	101.4		101.4				421.7
3.4.6.5	SEQUENCE DISPLAY UNIT	3	128.1	50.8		178.9	12.7	24.1		24.1				203.0
3.4.6.6	TIME DISPLAY	3	6.1	12.2		18.3	3.9	7.4		7.4				25.7
	TOTAL	3	274.9	311.9		586.8	94.7	180.0		180.0				766.8
3.4.8	CABLE ASSEMBLIES	3	17.7	7.0		24.7	33.2	63.1		63.1				87.8

FOLDOUT FRAME

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT		CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5	PARTICLE DETECTORS AND CHARACTERIZERS		3												
3.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT		3	176.2	100.0		276.2	28.8	54.8		54.8				331.0
3.5.2	OPTICAL PARTICLE COUNTER	CFD	3	55.2	81.3		136.5	23.8	45.3		45.3				181.8
3.5.3	PULSE HEIGHT ANALYZER	CFD	3	22.0	32.6		54.6	8.1	15.5		15.5				70.1
3.5.4	CONDENSATION NUCLEUS COUNTER	CFD, E	3	58.8	58.1		116.9	18.4	35.0		35.0				151.9
3.5.5	MICROPOROUS FILTER		3	8.6	5.8		14.4	5.0	9.2		9.2				23.6
3.5.6	QUARTZ CRYSTAL MASS MONITOR		3	84.9	79.2		164.1	22.7	42.9		42.9				207.0
3.5.7	CASCADE IMPACTOR		3	14.1	10.6		24.7	6.4	11.9		11.9				36.6
3.5.8	ELECTRICAL AEROSOL SIZE ANALYZER		3	218.4	304.4		522.8	82.7	157.3		157.3				680.1
3.5.9	SCATTEROMETER		3	108.0	125.7		233.7	31.4	59.7		59.7				293.4
3.5.10	LIQUID WATER CONTENT METER		3	34.3	94.8		129.1	27.1	51.5		51.5				180.6
3.5.11	DROPLET SIZE DISTRIBUTION METER		3	227.4	324.2		551.6	83.6	159.0		159.0				710.6
3.5.12	OPTICAL THERMOELECTRIC DEW POINT							—							
	HYGROMETER	X	3	129.2	115.0		244.2	31.3	59.4		59.4				303.6
3.5.13	ELECTRIC DEW POINT HYGROMETER	ALL	3	14.5	13.8		28.3	3.5	6.6		6.6				34.9
3.5.14	INSTRUMENTATION/DISPLAYS		3	3.3	5.2		8.5	16.9	32.0		32.0				40.5
	INITIAL SPARES		3							33.7	33.7				33.7
	OPERATIONAL SPARES		3										303.6	303.6	303.6
	TOTAL		3	1154.9	1350.7		2505.6	389.7	740.1	33.7	773.8		303.6	303.6	3583.0

FOLDOUT FRAME

FOLDOUT FRAME

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5.2	OPTICAL PARTICLE COUNTER	3												
3.5.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	5.1	7.0		12.1	1.7	3.3		3.3				15.4
3.5.2.2	SENSOR	3	18.3	27.1		45.4	6.8	12.9		12.9				58.3
3.5.2.3	PARTICLE COUNTER	3	31.8	47.2		79.0	11.8	22.4		22.4				101.4
3.5.2.4	VACUUM PUMP	3	0	0		0	0	0		0				0
3.5.2.5	VALVE	3	0	0		0	1.9	3.6		3.6				3.6
3.5.2.6	FLOW CONTROLLER	3	0	0		0	1.6	3.1		3.1				3.1
	TOTAL	3	55.2	81.3		136.5	23.8	45.3		45.3				181.8
3.5.3	PULSE HEIGHT ANALYZER	3												
3.5.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	1.6	2.5		4.1	0.6	1.2		1.2				5.3
3.5.3.2	ANALYZER WITH READOUT	3	17.8	26.3		44.1	6.6	12.5		12.5				56.6
3.5.3.3	OSCILLOSCOPE	3	2.6	3.8		6.4	0.9	1.8		1.8				8.2
	TOTAL	3	22.0	32.6		54.6	8.1	15.5		15.5				70.1
3.5.4	CONDENSATION NUCLEUS COUNTER	3												
3.5.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	5.3	5.3		10.6	1.4	2.6		2.6				13.2
3.5.4.2	COUNTER CONTROL	3	50.2	47.8		98.0	11.9	22.7		22.7				120.7
3.5.4.3	VALVE	3	0	0		0	2.3	4.3		4.3				4.3
3.5.4.4	POSITIVE DISPLACEMENT PUMP	3	2.7	4.0		6.7	1.0	1.9		1.9				8.6
3.5.4.5	VACUUM PUMP	3	0.6	1.0		1.6	0.2	0.4		0.4				2.0
3.5.4.6	FLOW CONTROLLER	3	0	0		0	1.6	3.1		3.1				3.1
	TOTAL	3	58.8	58.1		116.9	18.4	35.0		35.0	FOLDOUT FRAME			151.9
	FOLDOUT FRAME											2		
	1													

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5.5	MICROPOROUS FILTER	3												
3.5.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	1.6	1.6		3.2	0.4	0.7		0.7				3.9
3.5.5.2	FILTER HOUSING	3	0.7	0.7		1.4	0.2	0.3		0.3				1.7
3.5.5.3	VACUUM PUMP	3	0	0		0	0.2	0.4		0.4				0.4
3.5.5.4	FILTER STORAGE CONTAINER	3	5.2	2.0		7.2	0.5	0.9		0.9				8.1
3.5.5.5	NUCLEI SAMPLE FILTERS	3	0.1	0.1		0.2	0.1	0.1		0.1				0.3
3.5.5.6	VALVE	3	0	0		0	1.6	3.1		3.1				3.1
3.5.5.7	FLOW CONTROLLER	3	0	0		0	1.6	3.0		3.0				3.0
3.5.5.8	TIMER/CLOCK CONTROL	3	1.0	1.4		2.4	0.4	0.7		0.7				3.1
	TOTAL	3	8.6	5.8		14.4	5.0	9.2		9.2				23.6
3.5.6	QUARTZ CRYSTAL MASS MONITOR	3												
3.5.6.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	7.3	7.0		14.3	1.7	3.2		3.2				17.5
3.5.6.2	PARTICLE MASS MONITOR	3	77.6	72.2		149.8	18.1	34.3		34.3				184.1
3.5.6.3	FLOW CONTROLLER	3	0	0		0	1.6	3.0		3.0				3.0
3.5.6.4	VALVE	3	0	0		0	1.1	2.0		2.0				2.0
3.5.6.5	VACUUM PUMP	3	0	0		0	0.2	0.4		0.4				0.4
	TOTAL	3	84.9	79.2		164.1	22.7	42.9		42.9				207.0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5.7	CASCADE IMPACTOR	3												
3.5.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	2.1	2.0		4.1	0.5	0.9		0.9				5.0
3.5.7.2	CASCADE IMPACTOR HOUSING	3	6.7	6.4		13.1	1.6	3.0		3.0				16.1
3.5.7.3	VACUUM PUMP	3	0	0		0	0.2	0.4		0.4				0.4
3.5.7.4	SLIDE STORAGE CONTAINER	3	5.2	2.0		7.2	0.5	0.9		0.9				8.1
3.5.7.5	SLIDES	3	0.1	0.2		0.3	0.1	0.1		0.1				0.4
3.5.7.6	FLOW CONTROLLER	3	0	0		0	1.6	3.0		3.0				3.0
3.5.7.7	VALVE	3	0	0		0	1.6	3.0		3.0				3.0
3.5.7.8	TIMER/CLOCK CONTROLLER	3	0	0		0	0.3	0.6		0.6				0.6
	TOTAL	3	14.1	10.6		24.7	6.4	11.9		11.9				36.6
3.5.8	ELECTRICAL AEROSOL SIZE ANALYZER	3												
3.5.8.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	17.2	23.6		40.8	6.1	11.6		11.6				52.4
3.5.8.2	FLOW MODULE	3	201.2	280.8		482.0	70.2	133.4		133.4				615.4
3.5.8.3	CONTROL CIRCUIT/READOUT	3	0	0		0	0	0		0				0
3.5.8.4	VACUUM PUMP	3	0	0		0	0.2	0.4		0.4				0.4
3.5.8.5	FLOW CONTROLLER	3	0	0		0	4.7	9.0		9.0				9.0
3.5.8.6	VALVE	3	0	0		0	1.5	2.9		2.9				2.9
	TOTAL	3	218.9	304.4		522.8	82.7	157.3		157.3				680.1
3.5.9	SCATTEROMETER	3												
3.5.9.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	8.0	9.3		12.3	2.3	4.4		4.4				21.7
2.5.9.2	PHOTO DETECTOR	3	1.2	1.7		2.9	0.4	0.8		0.8				3.7
3.5.9.3	INDEXING MOUNT	3	27.3	40.0		67.3	10.0	19.0		19.0				66.3
3.5.9.4	LASER LIGHT SOURCE	3	18.7	26.7		45.4	6.7	12.7		12.7				58.1
3.5.9.5	ELECTRONICS AND CONTROLS	3	52.8	48.0		100.8	12.0	22.8		22.8				123.6
	TOTAL	3	108.0	125.7		233.7	31.4	59.7		59.7				293.4

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5.10	LIQUID WATER CONTENT METER	3												
3.5.10.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	7.9	7.0		14.9	2.0	3.8		3.8				18.7
3.5.10.2	PHOTO DETECTOR	3	0	2.5		2.5	1.1	2.1		2.1				4.6
3.5.10.3	LASER LIGHT SOURCE	3	0	13.3		13.3	6.0	11.4		11.4				24.7
3.5.10.4	ELECTRONICS AND CONTROLS	3	26.4	72.0		98.4	18.0	34.2		34.2				132.6
	TOTAL	3	34.3	94.8		129.1	27.1	51.5		51.5				180.6
3.5.11	DROPLET SIZE DISTRIBUTION METER	3												
3.5.11.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	24.1	24.0		48.1	6.2	11.8		11.8				59.9
3.5.11.2	PHOTO DETECTOR	3	59.8	84.4		144.2	21.1	40.1		40.1				184.3
3.5.11.3	LASER LIGHT SOURCE	3	0	13.3		13.3	5.7	10.9		10.9				24.2
3.5.11.4	ELECTRONICS AND CONTROLS	3	143.5	202.5		346.0	50.6	96.2		96.2				442.2
	TOTAL	3	227.4	324.2		551.6	83.6	159.0		159.0				710.6
3.5.12	OPTICAL THERMOELECTRIC DEW POINT													
	HYGROMETER	3												
3.5.12.1	INSTALLATION, ASSEMBLY, AND CHECKOUT	3	10.5	9.5		20.0	2.3	4.4		4.4				24.4
3.5.12.2	SENSOR	3	118.7	105.5		224.2	26.4	50.1		50.1				274.3
3.5.12.3	SENSING UNIT	3	0	0		0	0	0		0				0
3.5.12.4	READOUT	3	0	0		0	0	0		0				0
3.5.12.5	VALVE	3	0	0		0	1.0	1.9		1.9				1.9
3.5.12.6	FLOW CONTROLLER	3	0	0		0	1.6	3.0		3.0				3.0
	TOTAL	3	129.2	115.0		244.2	31.3	59.4		59.4				303.6

FOLDOUT FRAME

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.5.13	ELECTRIC DEW POINT HYGROMETER	3												
3.5.13.1	INSTALLATION, ASSEMBLY, AND CHECKOUT	3	1.1	1.0		2.1	0.3	0.5		0.5				2.6
3.5.13.2	DEW POINT HYGROMETER	3	12.3	11.8		24.1	2.9	5.6		5.6				29.7
3.5.13.3	SENSOR	3	1.1	1.0		2.1	0.3	0.5		0.5				2.6
	TOTAL	3	14.5	13.8		28.3	3.5	6.6		6.6				34.9
3.5.14	INSTRUMENTATION/DISPLAYS	3												
3.5.14.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	1.5	2.6		4.1	1.3	2.4		2.4				6.5
3.5.14.2	VOLTAGE SENSORS	3	0.9	1.3		2.2	2.2	4.2		4.2				6.4
3.5.14.3	CURRENT SENSORS	3	0.9	1.3		2.2	1.7	3.3		3.3				5.5
3.5.14.4	TEMPERATURE SENSORS	3	0	0		0	0.3	0.5		0.5				0.5
3.5.14.5	AIR FLOW SENSORS	3	0	0		0	5.0	9.5		9.5				9.5
3.5.14.6	PRESSURE SENSORS	3	0	0		0	2.4	4.5		4.5				4.5
3.5.14.7	FREQUENCY SENSORS	3	0	0		0	2.3	4.3		4.3				4.3
3.5.14.8	DISPLAYS	3	0	0		0	1.7	3.3		3.3				3.3
	TOTAL	3	3.3	5.2		8.5	16.9	32.0		32.0				40.5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.6	EXPERIMENT CHAMBERS	3												
3.6.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	124.3	75.1		199.4	55.6	105.7		105.7				305.4
3.6.2	STATIC DIFFUSION LIQUID CHAMBER ASSEMBLY	3	143.3	53.8		197.1	51.7	98.3		98.3				295.4
3.6.3	STATIC DIFFUSION ICE CHAMBER ASSEMBLY	3	402.0	155.6		557.6	122.6	232.7		232.7				790.3
3.6.4	GENERAL CHAMBER ASSEMBLY	3	202.1	172.6		374.7	131.4	249.6		249.6				624.3
3.6.5	EXPANSION CHAMBER ASSEMBLY	3	202.1	267.9		470.0	198.3	377.0		377.0				847.0
3.6.6	CONTINUOUS FLOW DIFFUSION CHAMBER													
	ASSEMBLY	3	164.8	100.8		265.6	69.1	131.5		131.5				397.1
3.6.7	EARTH SIMULATION CHAMBER ASSEMBLY	3	253.7	95.4		349.1	53.2	101.1		101.1				450.2
3.6.8	NUCLEI CONDITIONING ASSEMBLY	3	186.2	93.0		279.2	69.0	130.9		130.9				410.1
	INITIAL SPARES	3							65.0					65.0
	OPERATIONAL SPARES	3										585.3		585.3
	TOTAL	3	1678.5	1014.2		2692.7	750.9	1426.8	65.0	1491.8		585.3	585.3	4769.8

FOLDOUT FRAME

FOLDOUT FRAME

2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.6.2	STATIC DIFFUSION LIQUID CHAMBER ASSEMBLY	3												
3.6.2.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	64.6	4.0		68.6	25.9	49.2		49.2				117.8
3.6.2.2	CHAMBER WALL SUBASSEMBLY	3	60.6	31.3		91.9	16.6	31.6		31.6				123.5
3.6.2.3	OPTICAL PORTS	3	0.1	0.2		0.3	0.1	0.2		0.2				0.5
3.6.2.4	EQUIPMENT MOUNTING PORTS	3	5.2	2.0		7.2	1.4	2.6		2.6				9.8
3.6.2.5	WATER WICKING SURFACES	3	0.6	0.3		0.9	0.1	0.2		0.2				1.1
3.6.2.6	LIGHT TRAP	3	11.8	4.0		15.8	2.8	5.3		5.3				21.1
3.6.2.7	THERMAL CONTROLLERS	3	0	2.1		2.1	0.9	1.8		1.8				3.9
3.6.2.8	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	9.9		10.3	3.9	7.4		7.4				17.7
	TOTAL	3	143.3	53.8		197.1	51.7	98.3		98.3				295.4
3.6.3	STATIC DIFFUSION ICE CHAMBER ASSEMBLY	3												
3.6.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	202.1	11.5		213.6	61.3	116.4		116.4				330.0
3.6.3.2	CHAMBER WALL SUBASSEMBLY	3	133.9	46.3		180.2	25.9	49.2		49.2				229.4
3.6.3.3	OPTICAL PORTS	3	0	0.3		0.3	0.2	0.3		0.3				0.6
3.6.3.4	EQUIPMENT MOUNTING PORTS	3	0	9.0		9.0	3.6	6.8		6.8				15.8
3.6.3.5	WATER WICKING SURFACES	3	0	0.3		0.3	0.1	0.2		0.2				0.5
3.6.3.6	ELECTRIC FIELD SUBASSEMBLY	3	20.2	29.0		49.2	9.3	17.6		17.6				66.8
3.6.3.7	OPTICAL CONDITIONING SUBASSEMBLY	3	19.8	20.3		40.1	6.2	11.8		11.8				51.9
3.6.3.8	ACOUSTICAL SUBASSEMBLY	3	3.8	6.4		10.2	4.1	7.8		7.8				18.0
3.6.3.9	SCATTEROMETER INTERFACE EQUIPMENT	3	21.8	8.0		29.8	2.0	3.8		3.8				33.6
3.6.3.10	LIGHT TRAPS	3	0	8.0		8.0	3.3	6.2		6.2				14.2
3.6.3.11	THERMAL CONTROLLERS	3	0	4.2		4.2	1.8	3.4		3.4				7.6
3.6.3.12	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	12.3		12.7	4.8	9.2		9.2	FOLDOUT FRAME			21.9
	TOTAL	3	402.0	155.6		557.6	122.6	232.7		232.7		2		790.3
	FOLDOUT FRAME													

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.6.4	GENERAL CHAMBER ASSEMBLY	3												
3.6.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	201.7	12.8		214.5	65.7	124.8		124.8				339.3
3.6.4.2	CHAMBER WALL SUBASSEMBLY	3	0	81.1		81.1	33.0	62.7		62.7				143.8
3.6.4.3	OPTICAL PORTS	3	0	0.3		0.3	0.1	0.2		0.2				0.5
3.6.4.4	EQUIPMENT MOUNTING PORTS	3	0	9.0		9.0	3.4	6.4		6.4				15.4
3.6.4.5	ELECTRIC FIELD SUBASSEMBLY	3	0	19.8		19.8	8.6	16.4		16.4				36.2
3.6.4.6	OPTICAL CONDITIONING SUBASSEMBLY	3	0	12.9		12.9	5.7	10.9		10.9				23.8
3.6.4.7	ACOUSTICAL SUBASSEMBLY	3	0	9.0		9.0	3.7	7.1		7.1				16.1
3.6.4.8	LIGHT TRAPS	3	0	8.0		8.0	3.2	6.0		6.0				14.0
3.6.4.9	SCATTEROMETER INTERFACE EQUIPMENT	3	0	4.0		4.0	1.8	3.4		3.4				7.4
3.6.4.10	THERMAL CONTROLLER	3	0	2.1		2.1	0.9	1.7		1.7				3.8
3.6.4.11	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	13.6		14.0	5.3	10.0		10.0				24.0
	TOTAL	3	202.1	172.6		374.7	131.4	249.6		249.6				624.3
3.6.5	EXPANSION CHAMBER ASSEMBLY	3												
3.6.5.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	201.7	19.9		221.6	99.2	188.5		188.5				410.1
3.6.5.2	CHAMBER WALL SUBASSEMBLY	3	0	139.9		139.9	53.7	102.1		102.1				242.0
3.6.5.3	OPTICAL PORTS	3	0	0.3		0.3	0.1	0.2		0.2				0.5
3.6.5.4	EQUIPMENT MOUNTING PORTS	2	0	7.0		7.0	2.6	4.9		4.9				11.9
3.6.5.5	ELECTRIC FIELD SUBASSEMBLY	3	0	19.7		19.7	8.4	15.9		15.9				35.6
3.6.5.6	OPTICAL HEATING SUBASSEMBLY	3	0	12.9		12.9	5.5	10.5		10.5				23.4
3.6.5.7	ACOUSTICAL SUBASSEMBLY	3	0	9.0		9.0	3.6	6.8		6.8				15.8
3.6.5.8	EXPANSION CONTROLLER SUBASSEMBLY	3	0	36.0		36.0	16.2	30.8		30.8				66.8
3.6.5.9	LIGHT TRAPS	3	0	4.0		4.0	1.5	2.9		2.9				6.9
3.6.5.10	SCATTEROMETER/INTERFACE EQUIPMENT	3	0	4.0		4.0	1.7	3.3		3.3				7.3
3.6.5.11	THERMAL CONTROLLER	3	0	2.1		2.1	0.8	1.6		1.6				3.7
3.6.5.12	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	13.1		13.5	5.0	9.5		9.5				23.0
	TOTAL	3	202.1	267.9		470.0	198.3	377.0		377.0				847.0

FOLDOUT FRAME

FOLDOUT FRAME

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.6.6	CONTINUOUS FLOW DIFFUSION CHAMBER													
	ASSEMBLY	3												
3.6.6.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	142.0	7.5		149.5	34.6	65.8		65.8				215.3
3.6.6.2	CHAMBER PLATE SUBASSEMBLY	3	0	58.6		58.6	22.1	42.0		42.0				100.6
3.6.6.3	OPTICAL PORTS	3	0	0.2		0.2	0.1	0.1		0.1				0.3
3.6.6.4	WATER WICKING SURFACES	3	0	0.3		0.3	0.1	0.2		0.2				0.5
3.6.6.5	CARRIER AIR SUBASSEMBLY	3	0.4	4.9		5.3	1.9	3.7		3.7				9.0
3.6.6.6	SHEATH AIR SUBASSEMBLY	3	21.8	12.3		34.1	3.7	7.1		7.1				41.2
3.6.6.7	THERMAL CONTROLLERS	3	0	2.1		2.1	0.8	1.6		1.6				3.7
3.6.6.8	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.6	14.9		15.5	5.8	11.0		11.0				26.5
	TOTAL	3	164.8	100.8		265.6	69.1	131.5		131.5				397.1
3.6.7	EARTH SIMULATION CHAMBER ASSEMBLY	3												
3.6.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	135.9	7.1		143.0	26.6	50.5		50.5				193.5
3.6.7.2	EARTH SIMULATION MODEL	3	72.5	10.0		82.5	2.5	4.8		4.8				87.3
3.6.7.3	ROTATING SUBASSEMBLY	3	42.0	40.0		82.0	10.0	19.0		19.0				101.0
3.6.7.4	HIGH VOLTAGE SUBASSEMBLY	3	0	17.7		17.7	7.4	14.0		14.0				31.7
3.6.7.5	FAN (MODEL COOLING)	3	0.2	0.5		0.7	0.1	0.2		0.2				0.9
3.6.7.6	OPTICAL COMPONENTS MOUNTING SUBASSEMBLY	3	2.7	8.0		10.7	2.0	3.8		3.8				14.5
3.6.7.7	THERMAL CONTROLLERS	3	0	2.1		2.1	0.8	1.6		1.6				3.7
3.6.7.8	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	10.0		10.4	3.8	7.2		7.2				17.6
	TOTAL	3	253.7	95.4		349.1	53.2	101.1		101.1				450.2

FOLDOUT FRAME 1

FOLDOUT FRAME 2

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.6.8	NUCLEI CONDITIONING ASSEMBLY	3												
3.6.8.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	176.6	6.9		183.5	34.5	65.5		65.5				249.0
3.6.8.2	CHAMBER SUBASSEMBLY	3	0.6	37.5		38.1	16.1	30.5		30.5				68.6
3.6.8.3	AEROSOL CONDITIONING SUBASSEMBLY	3	0	12.9		12.9	5.4	10.3		10.3				23.2
3.6.8.4	ACOUSTICAL SUBASSEMBLY	3	0	9.0		9.0	3.5	6.6		6.6				15.6
3.6.8.5	NUCLEI PRECONDITIONER SUBASSEMBLY	3	8.6	4.0		12.6	1.0	1.9		1.9				14.5
3.6.8.6	VALVES	3	0	12.3		12.3	4.5	8.5		8.5				20.8
3.6.8.7	THERMAL CONTROLLER	3	0	2.1		2.1	0.8	1.6		1.6				3.7
3.6.8.8	INSTRUMENTATION AND DISPLAY SUBASSEMBLY	3	0.4	8.3		8.7	3.2	6.0		6.0				14.7
	TOTAL	3	186.2	93.0		279.2	69.0	130.9		130.9				410.1

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.7	CONSOLE	3												
3.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	42.9	83.8		126.7	30.6	58.2	0	58.2				184.9
3.7.2	CONSOLE SUPPORT STRUCTURE AND SUBASSEMBLY	3	111.7	793.8		905.5	278.5	529.2	0	529.2				1434.7
3.7.3	POWER CONTROL AND DISTRIBUTION	3	46.8	100.4		147.2	65.0	123.5	5.6	129.1		50.7	50.7	327.0
3.7.4	CONSOLE PANELS AND DRAWER SUBASSEMBLY	3	377.7	145.2		522.9	36.3	69.0	0	69.0				591.9
3.7.5	OVERHEAD STORAGE SUBASSEMBLY	3	0	0		0	0	0	0	0				0
3.7.6	FLOOR SEGMENT SUBASSEMBLY	3	0	0		0	0	0	0	0				0
3.7.7	INSTRUMENTATION/DISPLAYS	3	0	8.8		8.8	3.2	6.1	0.3	6.4		2.5	2.5	17.7
	TOTAL	3	579.1	1132.0		1711.1	413.6	786.0	5.9	791.9		53.2	53.2	2556.2

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO (T1)	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.8	OPTICAL DETECTION AND IMAGING DEVICES	3												
3.8.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	3	86.3	90.6		176.9	23.1	43.8		43.8				220.7
3.8.2	CINE CAMERA	3	60.8	91.0		151.8	22.7	43.2		43.2				195.0
3.8.3	STILL CAMERA (35 MM) SDI E	3	31.0	46.4		77.4	11.6	22.0		22.0				99.4
3.8.4	MICROSCOPE TRINOCULAR	3	13.9	20.8		34.7	5.2	9.9		9.9				44.6
3.8.5	VIDEO CAMERA ASSEMBLY	3	29.4	44.0		73.4	11.0	20.9		20.9				94.3
3.8.6	LIGHT SOURCE SDI E	3	1.6	2.4		4.0	1.2	2.2		2.2				6.2
3.8.7	ANEMOMETER	3	202.5	303.0		505.5	75.7	143.9		143.9				649.4
3.8.8	STEREO MICROSCOPE	3	32.9	32.1		65.0	8.0	15.2		15.2				80.2
3.8.9	IR MICROSCOPE	3	628.9	571.7		1200.6	142.9	271.6		271.6				1472.2
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES 50%	3	68.5	14.6		83.1	5.9	11.2		11.2	168.0		168.0	262.3
3.8.11	DISPLAYS	3	8.7	6.3		15.0	3.8	7.3		7.3				22.3
	INITIAL SPARES	3							26.9	26.9				26.9
	OPERATIONAL SPARES	3										242.5	242.5	242.5
	TOTAL	3	1164.5	1222.9		2387.4	311.1	591.2	26.9	618.1	168.0	242.5	410.5	3416.0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES	3												
3.8.10.1	COUPLING OPTICS	3	65.4	12.0		77.4	3.0	5.7		5.7				83.1
3.8.10.2	EXPOSURE METER	3	0.7	1.4		2.1	0.4	0.7		0.7				2.8
3.8.10.3	SPOOLS	3	0	0		0	0	0		0				0
3.8.10.4	FILM (34 MM)	3	0	0		0	0	0		0				0
3.8.10.5	VIEWPORTS	3	2.4	1.2		3.6	2.5	4.8		4.8				8.4
	TOTAL	3	68.5	14.6		83.1	5.9	11.2		11.2	168.0		168.0	262.3
3.8.11	DISPLAYS	3												
3.8.11.1	DIGITAL	3	0.9	1.3		2.2	0.6	1.2		1.2				3.4
3.8.11.2	ANALOG	3	0.9	1.3		2.2	0.9	1.8		1.8				4.0
3.8.11.3	INDICATOR LIGHTS	3	0.2	0.3		0.5	0.7	1.3		1.3				1.8
3.8.11.4	CONTROLS	3	6.7	3.4		10.1	1.6	3.0		3.0				13.1
	TOTAL	3	8.7	6.3		15.0	3.8	7.3		7.3				22.3

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
5.0	SYSTEM TEST	3												
5.1	SYSTEM TEST PLANNING	3				28.8								28.3
5.2	MAJOR TEST ARTICLES	3				352.2								352.2
5.3	SYSTEM DEVELOPMENT TESTING	3				81.6								81.6
5.4	SYSTEM VERIFICATION TESTING	3				95.2								95.2
	TOTAL	3				557.8								557.8

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
6.0	GROUND SUPPORT EQUIPMENT (GSE)	3												
6.1	GSE INTEGRATION	3				419.4								419.4
6.2	ELECTRICAL/ELECTRONIC GSE	3				286.3								286.3
6.3	MECHANICAL GSE	3				286.3								286.3
6.4	TRANSPORTATION AND HANDLING GSE	3				89.9								89.9
6.5	GSE SOFTWARE	3				151.0								151.0
6.6	GSE MAINTENANCE	3								54.1			595.0	649.1
	TOTAL	3				1232.9				54.1			595.0	1882.0

FOLDOUT FRAME

FOLDOUT FRAME

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
8.0	LOGISTICS	3												
8.1	TRAINING	3				946.0							105.6	1051.6
8.2	TRANSPORTATION AND HANDLING	3				5.0				5.0			2.5	12.5
8.3	INVENTORY CONTROL	3				10.6							52.8	63.4
	TOTAL	3				961.6				5.0			160.9	1127.5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
9.0	GROUND OPERATIONS	3												
9.1	RECOVERY OPERATIONS	3											855.5	855.5
9.2	MAINTENANCE AND REFURBISHMENT ACTIVITIES	3											1241.9	1241.9
9.3	CHECKOUT OPERATIONS AND REFURBISHMENT													
	FOR FLIGHT	3											1999.9	1999.9
9.4	LAUNCH OPERATIONS	3											1056.3	1056.3
	TOTAL	3											5153.6	5153.6

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
10.0	FLIGHT OPERATIONS	3												
10.1	MISSION PLANNING	3											0	0
10.2	FLIGHT CONTROL AND EVLUATION	3											122.3	122.3
	TOTAL	3											122.3	122.3

FOLDOUT FRAME 1

FOLDOUT FRAME 2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272 COST MODEL SUMMARY

1974 DOLLARS IN THOUSANDS

WBS NO.	COST ELEMENT	CONF.	ED&D	GTH	FTH	TOTAL DDT&E	MEMO T_1	PROD	INIT. SPRS.	TOTAL PROD.	OPER. ACTIV.	OPS. SPRS.	TOTAL OPER.	TOTAL PROJ.
11.0	PRINCIPAL INVESTIGATOR (PI) OPERATIONS	3												
11.1	PI PLANNING OPERATIONS	3											1294.4	1294.4
11.2	PI PREFLIGHT OPERATIONS	3											3562.9	3562.9
11.3	PI FLIGHT/POSTFLIGHT OPERATIONS	3											1946.2	1946.2
	TOTAL	3											6803.5	6803.5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Cost Data (NASA Data Forms A(1), A(2) and A(3)

This subsection presents the Cloud Physics Laboratory cost estimates and funding characteristics on Data Form A(1) for Non-Recurring (DDT&E), Data Form A(2) for Recurring (Production) and Data Form A(3) for Recurring (Operations). All cost data shown on these forms is expressed in thousands of 1974 dollars.

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 1 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
1.0	PROJECT MANAGEMENT	4	549.6	3	45	45	0
2.0	SYSTEM ENGINEERING AND						
	INTEGRATION	4	1386.0	3	45	45	50
3.0	CLOUD PHYSICS EXPERIMENT						
	LABORATORY	4	16644.3	3	42	45	60
4.0	EXPERIMENT SUPPORT HARDWARE	4	0	3	-	-	-
5.0	SYSTEM TEST	4	557.8	3	42	45	40
6.0	GROUND SUPPORT EQUIPMENT (GSE)	4	1232.9	3	42	42	40
7.0	FACILITIES	4	0	3	-	-	-
8.0	LOGISTICS	4	961.6	3	24	24	50
9.0	GROUND OPERATIONS	4	0	3	-	-	-
10.0	FLIGHT OPERATIONS	4	0	3	-	-	-
11.0	PRINCIPAL INVESTIGATOR						
	OPERATIONS	4	0	3	-	-	-
	TOTAL	3	21332.2				

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
2.0	SYSTEM ENGINEERING AND INTEGRATION						
2.1	CPL/SPACELAB INTEGRATION	5	554.4	3	45	45	50
2.2	CLOUD PHYSICS LABORATORY	5	415.8	3	45	45	50
2.3	EXPERIMENT SUPPORT	5	138.6	3	45	45	50
2.4	GROUND SUPPORT EQUIPMENT	5	138.6	3	45	45	50
2.5	SAFETY, RELIABILITY & QUALITY ASSURANCE	5	138.6	3	45	45	50
	TOTAL	4	1386.0	3	45	45	50

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.0	CLOUD PHYSICS EXPERIMENT						
	LABORATORY						
3.1	FINAL ASSEMBLY, INTEGRATION &						
	CHECKOUT	5	792.6	3	42	45	60
3.2	THERMAL CONTROL/EXPENDABLES						
	STOR. & CONT.	5	2501.5	3	42	45	60
3.3	PARTICLE GENERATORS	5	1391.4	3	42	45	60
3.4	DATA MANAGEMENT	5	2662.0	3	42	45	60
3.5	PARTICLE DETECTORS &						
	CHARACTERIZERS	5	2505.6	3	42	45	60
3.6	EXPERIMENT CHAMBERS	5	2692.7	3	42	45	60
3.7	CONSOLE	5	1711.1	3	42	45	60
3.8	OPTICAL DETECTION & IMAGING						
	DEVICES	5	2387.4	3	42	45	60
	TOTAL	4	16644.3	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.2	THERMAL CONTROL/EXPENDABLES						
	STOR. & CONT.						
3.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	185.3	3	39	45	60
3.2.2	THERMAL CONTROL	6	970.3	3	39	45	60
3.2.3	FLOW, HUMIDITY, AND PRESSURE						
	CONTROL	6	919.7	3	39	45	60
3.2.4	EXPENDABLES STORAGE	6	221.2	3	39	45	60
3.2.5	INSTRUMENTATION & DISPLAY						
	SUBASSEMBLY	6	22.1	3	39	45	60
3.2.6	EXPENDABLES	6	0	3	39	45	60
3.2.7	CLEANSING, PURGE, & VENT						
	SUBASSEMBLY	6	182.9	3	39	45	60
	INITIAL SPARES						
	OPERATIONAL SPARES						
	TOTAL	5	2501.5	3	39	45	60

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.2.2	THERMAL CONTROL						
3.2.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	71.9	3	39	45	60
3.2.2.2	CLOUD CHAMBER COOLING						
	SUBASSEMBLY	7	825.7	3	39	45	60
3.2.2.3	SUPPORT EQUIPMENT COOLING						
	SUBASSEMBLY	7	72.7	3	39	45	60
	TOTAL	6	970.3	3	39	45	60
3.2.3	FLOW, HUMIDITY, AND PRESSURE						
	CONTROL						
3.2.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	68.1	3	39	45	60
3.2.3.2	HUMIDIFICATION SUBASSEMBLY	7	571.1	3	39	45	60
3.2.3.3	WATER STORAGE & SUPPLY						
	SUBASSEMBLY	7	280.5	3	39	45	60
	TOTAL	6	919.7	3	39	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.2.4	EXPENDABLES STORAGE						
3.2.4.1	INTEGRATION, ASSEMBLY AND						
	CHECKOUT	7	24.2	3	39	45	60
3.2.4.2	DRY AIR STORAGE SUBASSEMBLY	7	110.2	3	39	45	60
3.2.4.3	SAMPLE GAS STORAGE SUBASSEMBLY	7	86.8	3	39	45	60
	TOTAL	6	221.2	3	39	45	60
3.2.5	INSTRUMENTATION & DISPLAY						
	SUBASSEMBLY						
3.2.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	1.6	3	39	45	60
3.2.5.2	TEMPERATURE SENSORS	7	2.8	3	39	45	60
3.2.5.3	PRESSURE SENSORS	7	17.7	3	39	45	60
3.2.5.4	VISUAL DISPLAYS (NOT INCLUDED						
	HERE)	7	0	3	39	45	60
	TOTAL	6	22.1	3	39	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

PAGE 7 OF 44

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.2.6	EXPENDABLES						
3.2.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	0	3	0	0	0
3.2.6.2	AIR	7	0	3	0	0	0
3.2.6.3	SAMPLE GASES	7	0	3	0	0	0
3.2.6.4	WATER	7	0	3	0	0	0
	TOTAL	6	0	3	0	0	0
3.2.7	CLEANSING, PURGE, AND VENT						
	SUBASSEMBLY						
3.2.7.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	15.7	3	39	39	60
3.2.7.2	VALVES	7	18.0	3	39	39	60
3.2.7.3	FILTERS	7	68.3	3	39	39	60
3.2.7.4	DISTRIBUTION PLUMBING	7	80.9	3	39	39	60
	TOTAL	6	182.9	3	39	39	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3	PARTICLE GENERATORS						
3.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	172.7	3	41	45	60
3.3.2	WIRE PROBE RETRACTOR GENERATOR	6	272.4	3	41	45	60
3.3.3	WATER DROP IMPELLER GENERATOR	6	73.0	3	41	45	60
3.3.4	VIBRATING ORIFICE GENERATOR	6	273.9	3	41	45	60
3.3.5	EVAPORATOR/CONDENSER GENERATOR	6	91.7	3	41	45	60
3.3.6	SPRAY ATOMIZER GENERATOR	6	45.6	3	41	45	60
3.3.7	POWDER DISPERSION GENERATOR	6	70.1	3	41	45	60
3.3.8	PARTICLE INJECTOR & SIZE						
	CONDITIONER	6	338.2	3	41	45	60
3.3.9	INSTRUMENTATION/DISPLAYS	6	53.8	3	41	45	60
	INITIAL SPARES						
	OPERATIONSL SPARES						
	TOTAL	5	1391.4	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3.2	WIRE PROBE RETRACTOR GENERATOR						
3.3.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	20.2	3	41	45	60
3.3.2.2	DUAL PULSE GENERATOR	7	168.6	3	41	45	60
3.3.2.3	SWITCH	7	0.3	3	41	45	60
3.3.2.4	HIGH VOLTAGE PULSE GENERATOR	7	53.4	3	41	45	60
3.3.2.5	LINEAR ACTUATOR	7	9.3	3	41	45	60
3.3.2.6	WIRE PROBE RETRACTOR	7	16.5	3	41	45	60
3.3.2.7	VALVE	7	4.1	3	41	45	60
	TOTAL	6	272.4	3	41	45	60
3.3.3	WATER DROP IMPELLER GENERATOR						
3.3.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	5.9	3	41	45	60
3.3.3.2	HIGH VOLTAGE PULSE GENERATOR	7	53.3	3	41	45	60
3.3.3.3	SWITCH	7	0.1	3	41	45	60
3.3.3.4	SOLENOID DRIVER	7	2.6	3	41	45	60
3.3.3.5	WATER DROP IMPELLER	7	9.7	3	41	45	60
3.3.3.6	VALVE	7	1.4	3	41	45	60
	TOTAL	6	73.0	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3.4	VIBRATING ORIFICE GENERATOR						
3.3.4.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	20.7	3	41	45	60
3.3.4.2	FREQUENCY GENERATOR	7	50.6	3	41	45	60
3.3.4.3	POSITIVE DISPLACEMENT PUMP	7	10.6	3	41	45	60
3.3.4.4	VIBRATING ORIFICE	7	169.7	3	41	45	60
3.3.4.5	VALVE	7	0	3	41	45	60
3.3.4.6	FLOW CONTROLLER	7	22.3	3	41	45	60
	TOTAL	6	273.9	3	41	45	60
3.3.5	EVAPORATOR/CONDENSER GENERATOR						
3.3.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	7.7	3	41	45	60
3.3.5.2	EVAPORATOR FURNACE	7	50.8	3	41	45	60
3.3.5.3	CONDENSER	7	18.5	3	41	45	60
3.3.5.4	THERMAL CONTROLLER	7	6.3	3	41	45	60
3.3.5.5	FLOW CONTROLLER	7	4.3	3	41	45	60
3.3.5.6	VALVE	7	4.1	3	41	45	60
	TOTAL	6	91.7	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3.6	SPRAY ATOMIZER GENERATOR						
3.3.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	4.6	3	41	45	60
3.3.6.2	POSITIVE DISPLACEMENT PUMP	7	3.1	3	41	45	60
3.3.6.3	SPRAY ATOMIZER	7	28.1	3	41	45	60
3.3.6.4	FLOW CONTROLLER	7	4.3	3	41	45	60
3.3.6.5	VALVE	7	5.5	3	41	45	60
	TOTAL	6	45.6	3	41	45	60
3.3.7	POWDER DISPERSION GENERATOR						
3.3.7.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	6.1	3	41	45	60
3.3.7.2	POWDER DISPERSER	7	55.6	3	41	45	60
3.3.7.3	FLOW CONTROLLER	7	4.3	3	41	45	60
3.3.7.4	VALVE	7	4.1	3	41	45	60
	TOTAL	6	70.1	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3.8	PARTICLE INJECTOR & SIZE						
	CONDITIONER						
3.3.8.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	149.3	3	41	45	60
3.3.8.2	CONDITIONER WALL SUBASSEMBLY	7	34.0	3	41	45	60
3.3.8.3	OPTICAL PORTS	7	0.2	3	41	45	60
3.3.8.4	EQUIPMENT MOUNTING PORTS	7	4.0	3	41	45	60
3.3.8.5	WATER WICKING SURFACE	7	0.2	3	41	45	60
3.3.8.6	ACOUSTICAL SUBASSEMBLY	7	9.0	3	41	45	60
3.3.8.7	THERMAL CONTROLLER	7	4.2	3	41	45	60
3.3.8.8	VELOCITY CONTROLLER	7	124.8	3	41	45	60
3.3.8.9	SHUTTER VALVE	7	3.3	3	41	45	60
3.3.3.10	VALVES	7	1.3	3	41	45	60
3.3.8.11	INSTRUMENTATION AND DISPLAY	7	7.9	3	41	45	60
	TOTAL	6	338.2	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.3.9	INSTRUMENTATION/DISPLAYS						
3.3.9.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	4.0	3	41	45	60
3.3.9.2	VOLTAGE SENSORS	7	15.9	3	41	45	60
3.3.9.3	TEMPERATURE SENSORS	7	0.6	3	41	45	60
3.3.9.4	AIR FLOW SENSORS	7	4.8	3	41	45	60
3.3.9.5	POSITION SENSORS	7	4.4	3	41	45	60
3.3.9.6	FREQUENCY SENSORS	7	20.2	3	41	45	60
3.3.9.7	DISPLAYS	7	3.9	3	41	45	60
	TOTAL	6	53.8	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM — A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.4	DATA MANAGEMENT						
3.4.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	197.2	3	42	45	60
3.4.2	CONTROL PROCESSOR ASSEMBLY	6	741.9	3	42	45	60
3.4.3	TAPE RECORDER ASSEMBLY	6	0	3	42	45	60
3.4.4	MASTER CONTROL ASSEMBLY	6	203.3	3	42	45	60
3.4.5	SIGNAL CONDITIONING ELECTRONICS						
	ASSEMBLY	6	908.1	3	42	45	60
3.4.6	INTRUMENTATION AND DISPLAY						
	ASSEMBLY	6	586.8	3	42	45	60
3.4.7	EXPENDABLES	6	0	3	42	45	60
3.4.8	CABLE ASSEMBLIES	6	24.7	3	42	45	60
	INITIAL SPARES						
	OPERATIONAL SPARES						
	TOTAL	5	2662.0	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.4.2	CONTROL PROCESSOR ASSEMBLY						
3.4.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	54.9	3	42	45	60
3.4.2.2	CONTROL PROCESSOR	7	447.6	3	42	45	60
3.4.2.3	SOFTWARE	7	70.5	3	42	45	60
3.4.2.4	CONTROL UNITS	7	168.9	3	42	45	60
	TOTAL	6	741.9	3	42	45	60
3.4.4	MASTER CONTROL ASSEMBLY						
3.4.4.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	15.1	3	42	45	60
3.4.4.2	KEYBOARD	7	5.1	3	42	45	60
3.4.4.3	DISCRETE CONTROLS	7	183.1	3	42	45	60
	TOTAL	6	203.3	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.4.5	SIGNAL CONDITIONING ELECTRONICS						
	ASSEMBLY						
3.4.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	67.2	3	42	45	60
3.4.5.2	ANALOG CONDITIONING ELECTRONICS	7	163.0	3	42	45	60
3.4.5.3	DIGITAL CONDITIONING ELECTRONICS	7	163.0	3	42	45	60
3.4.5.4	FORMATTER	7	510.7	3	42	45	60
3.4.5.5	RAU	7	0	3	42	45	60
3.4.5.6	INTERCOM	7	4.2	3	42	45	60
3.4.5.7	CAUTION/WARNING ELECTRONICS	7	0	3	42	45	60
	TOTAL	6	908.1	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.4.6	INTRUMENTATION AND DISPLAY						
	ASSEMBLY						
3.4.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	43.5	3	42	45	60
3.4.6.2	INSTRUMENTATION	7	17.3	3	42	45	60
3.4.6.3	VIDEO MONITOR	7	8.5	3	42	45	60
3.4.6.4	GRAPHICS DISPLAY UNIT	7	320.3	3	42	45	60
3.4.6.5	SEQUENCE DISPLAY UNIT	7	178.9	3	42	45	60
3.4.6.6	TIME DISPLAY	7	18.3	3	42	45	60
	TOTAL	6	586.8	3	42	45	60
3.4.8	CABLE ASSEMBLIES	6	24.7	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5	PARTICLE DETECTORS AND						
	CHARACTERIZERS						
3.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	276.2	3	41	45	60
3.5.2	OPTICAL PARTICLE COUNTER	6	136.5	3	41	45	60
3.5.3	PULSE HEIGHT ANALYZER	6	54.6	3	41	45	60
3.5.4	CONDENSATION NUCLEUS COUNTER	6	116.9	3	41	45	60
3.5.5	MICROPOROUS FILTER	6	14.4	3	41	45	60
3.5.6	QUARTZ CRYSTAL MASS MONITOR	6	164.1	3	41	45	60
3.5.7	CASCADE IMPACTOR	6	24.7	3	41	45	60
3.5.8	ELECTRICAL AEROSOL SIZE						
	ANALYZER	6	522.8	3	41	45	60
3.5.9	SCATTEROMETER	6	233.7	3	41	45	60
3.5.10	LIQUID WATER CONTENT METER	6	129.1	3	41	45	60
3.5.11	DROPLET SIZE DISTRIBUTION METER	6	551.6	3	41	45	60
3.5.12	OPTICAL THERMOELECTRIC DEW						
	POINT HYDROMETER	6	244.2	3	41	45	60
3.5.13	ELECTRIC DEW POINT HYGROMETER	6	28.3	3	41	45	60
3.5.14	INSTRUMENTATION/DISPLAYS	6	8.5	3	41	45	60
	INITIAL SPARES						
	OPERATIONAL SPARES						
	TOTAL	5	2505.6	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.2	OPTICAL PARTICLE COUNTER						
3.5.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	12.1	3	41	45	60
3.5.2.2	SENSOR	7	45.4	3	41	45	60
3.5.2.3	PARTICLE COUNTER	7	79.0	3	41	45	60
3.5.2.4	VACUUM PUMP	7	0	3	41	45	60
3.5.2.5	VALVE	7	0	3	41	45	60
3.5.2.6	FLOW CONTROLLER	7	0	3	41	45	60
	TOTAL	6	136.5	3	41	45	60
3.5.3	PULSE HEIGHT ANALYZER						
3.5.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	4.1	3	41	45	60
3.5.3.2	ANALYZER WITH READOUT	7	44.1	3	41	45	50
3.5.3.3	OSCILLOSCOPE	7	6.4	3	41	45	60
	TOTAL	6	54.6	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 20 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.4	CONDENSATION NUCLEUS COUNTER						
3.5.4.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	10.6	3	41	45	60
3.5.4.2	COUNTER CONTROL	7	98.0	3	41	45	60
3.5.4.3	VALVE	7	0	3	41	45	60
3.5.4.4	POSTITIVE DISPLACEMENT PUMP	7	0	3	41	45	60
3.5.4.5	VACCUM PUMP	7	6.7	3	41	45	60
3.5.4.6	FLOW CONTROLLER	7	0	3	41	45	60
	TOTAL	6	116.9	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.5	MICROPOROUS FILTER						
3.5.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	3.2	3	41	45	60
3.5.5.2	FILTER HOUSING	7	1.4	3	41	45	60
3.5.5.3	VACUUM PUMP	7	0	3	41	45	60
3.5.5.4	FILTER STORAGE CONTAINER	7	7.2	3	41	45	60
3.5.5.5	NUCLEI SAMPLE FILTERS	7	0.2	3	41	45	60
3.5.5.6	VALVE	7	0	3	41	45	60
3.5.5.7	FLOW CONTROLLER	7	0	3	41	45	60
3.5.5.8	TIMER/CLOCK CONTROL	7	2.4	3	41	45	60
	TOTAL	6	14.4	3	41	45	60
3.5.6	QUARTZ CRYSTAL MASS MONITOR						
3.5.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	14.3	3	41	45	60
3.5.6.2	PARTICLE MASS MONITOR	7	149.8	3	41	45	60
3.5.6.3	FLOW CONTROLLER	7	0	3	41	45	60
3.5.6.4	VALVE	7	0	3	41	45	60
3.5.6.5	VACUUM PUMP	7	0	3	41	45	60
	TOTAL	6	164.1	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.7	CASCADE IMPACTOR						
3.5.7.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	4.1	3	41	45	60
3.5.7.2	CASCADE IMPACTOR HOUSING	7	13.1	3	41	45	60
3.5.7.3	VACUUM PUMP	7	0	3	41	45	60
3.5.7.4	SLIDE STORAGE CONTAINER	7	7.2	3	41	45	60
3.5.7.5	SLIDES	7	0.3	3	41	45	60
3.5.7.6	FLOW CONTROLLER	7	0	3	41	45	60
3.5.7.7	VALVE	7	0	3	41	45	60
3.5.7.8	TIMER/CLOCK CONTROLLER	7	0	3	41	45	60
	TOTAL	6	24.7	3	41	45	60
3.5.8	ELECTRICAL AEROSOL SIZE ANALYZER						
3.5.8.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	40.8	3	41	45	60
3.5.8.2	FLOW MODULE	7	482.8	3	41	45	60
3.5.8.3	CONTROL CIRCUIT/READOUT	7	0	3	41	45	60
3.5.8.4	VACUUM PUMP	7	0	3	41	45	60
3.5.8.5	FLOW CONTROLLER	7	0	3	41	45	60
3.5.8.6	VALVE	7	0	3	41	45	60
	TOTAL	6	522.8	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.9	SCATTEROMETER						
3.5.9.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	17.3	3	41	45	60
3.5.9.2	PHOTO DETECTOR	7	2.9	3	41	45	60
3.5.9.3	INDEXING MOUNT	7	67.3	3	41	45	60
3.5.9.4	LASER LIGHT SOURCE	7	45.4	3	41	45	60
3.5.9.5	ELECTRONICS AND CONTROLS	7	100.8	3	41	45	60
	TOTAL	6	233.7	3	41	45	60
3.5.10	LIQUID WATER CONTENT METER						
3.5.10.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	14.9	3	41	45	60
3.5.10.2	PHOTO DETECTOR	7	2.5	3	41	45	60
3.5.10.3	LASER LIGHT SOURCE	7	13.3	3	41	45	60
3.5.10.4	ELECTRONICS AND CONTROLS	7	98.4	3	41	45	60
	TOTAL	6	129.1	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.11	DROPLET SIZE DISTRIBUTION METER						
3.5.11.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	48.1	3	41	45	60
3.5.11.2	PHOTO DETECTOR	7	144.2	3	41	45	60
3.5.11.3	LASER LIGHT SOURCE	7	13.3	3	41	45	60
3.5.11.4	ELECTRONICS AND CONTROLS	7	346.0	3	41	45	60
	TOTAL	6	551.6	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.12	OPTICAL THERMOELECTRIC POINT						
	HYGROMETER						
3.5.12.1	INSTALLATION, ASSEMBLY, AND						
	CHECKOUT	7	20.0	3	41	45	60
3.5.12.2	SENSOR	7	224.2	3	41	45	60
3.5.12.3	SENSING UNIT	7	0	3	41	45	60
3.5.12.4	READOUT	7	0	3	41	45	60
3.5.12.5	VALVE	7	0	3	41	45	60
3.5.12.6	FLOW CONTROLLER	7	0	3	41	45	60
	TOTAL	6	244.2	3	41	45	60
3.5.13	ELECTRIC DEW POINT HYGROMETER						
3.5.13.1	INSTALLATION, ASSEMBLY, AND						
	CHECKOUT	7	2.1	3	41	45	60
3.5.13.2	DEW POINT HYGROMETER	7	24.1	3	41	45	60
3.5.13.3	SENSOR	7	2.1	3	41	45	60
	TOTAL	6	28.3	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 26 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.5.14	INSTRUMENTATION/DISPLAYS						
3.5.14.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	4.1	3	41	45	60
3.5.14.2	VOLTAGE SENSORS	7	2.2	3	41	45	60
3.5.14.3	CURRENT SENSORS	7	2.2	3	41	45	60
3.5.14.4	TEMPERATURE SENSORS	7	0	3	41	45	60
3.5.14.5	AIR FLOW SENSORS	7	0	3	41	45	60
3.5.14.6	PRESSURE SENSORS	7	0	3	41	45	60
3.5.14.7	FREQUENCY SENSORS	7	0	3	41	45	60
3.5.14.8	DISPLAYS	7	0	3	41	45	60
	TOTAL	6	8.5	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

PAGE 27 OF 44

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6	EXPERIMENT CHAMBERS						
3.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	199.4	3	41	45	60
3.6.2	STATIC DIFFUSION LIQUID CHAMBER						
	ASSEMBLY	6	197.1	3	41	45	60
3.6.3	STATIC DIFFUSION ICE CHAMBER						
	ASSEMBLY	6	557.6	3	41	45	60
3.6.4	GENERAL CHAMBER ASSEMBLY	6	374.7	3	41	45	60
3.6.5	EXPANSION CHAMBER ASSEMBLY	6	470.0	3	41	45	60
3.6.6	CONTINUOUS FLOW DIFFUSION						
	CHAMBER ASSEMBLY	6	265.6	3	41	45	60
3.6.7	EARTH SIMULATION CHAMBER						
	ASSEMBLY	6	349.1	3	41	45	60
3.6.8	NUCLEI CONDITIONING ASSEMBLY	6	279.2	3	41	45	60
	INITIAL SPARES						
	OPERATIONAL SPARES						
	TOTAL	5	2692.7	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.2	STATIC DIFFUSION LIQUID						
	CHAMBER ASSEMBLY						
3.6.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	68.6	3	41	45	60
3.6.2.2	CHAMBER WALL SUBASSEMBLY	7	91.9	3	41	45	60
3.6.2.3	OPTICAL PORTS	7	0.3	3	41	45	60
3.6.2.4	EQUIPMENT MOUNTING PORTS	7	7.2	3	41	45	60
3.6.2.5	WATER WICKING SURFACES	7	0.9	3	41	45	60
3.6.2.6	LIGHT TRAP	7	15.8	3	41	45	60
3.6.2.7	THERMAL CONTROLLERS	7	2.1	3	41	45	60
3.6.2.8	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	10.3	3	41	45	60
	TOTAL	6	197.1	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 29 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.3	STATIC DIFFUSION ICE CHAMBER						
	ASSEMBLY						
3.6.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	213.6	3	41	45	60
3.6.3.2	CHAMBER WALL SUBASSEMBLY	7	180.2	3	41	45	60
3.6.2.3	OPTICAL PORTS	7	0.3	3	41	45	60
3.6.3.4	EQUIPMENT MOUNTING PORTS	7	9.0	3	41	45	60
3.6.3.5	WATER WICKING SURFACES	7	0.3	3	41	45	60
3.6.3.6	ELECTRIC FIELD SUBASSEMBLY	7	49.2	3	41	45	60
3.6.3.7	OPTICAL CONDITIONING SUBASSEMBLY	7	40.1	3	41	45	60
3.6.3.8	ACOUSTICAL SUBASSEMBLY	7	10.2	3	41	45	60
3.6.3.9	SCATTEROMETER INTERFACE						
	EQUIPMENT	7	29.8	3	41	45	60
3.6.3.10	LIGHT TRAPS	7	8.0	3	41	45	60
3.6.3.11	THERMAL CONTROLLERS	7	4.2	3	41	45	60
3.6.3.12	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	12.7	3	41	45	60
	TOTAL	6	557.6	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s'	SPREAD FUNCTION
3.6.4	GENERAL CHAMBER ASSEMBLY						
3.6.4.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	214.5	3	41	45	60
3.6.4.2	CHAMBER WALL SUBASSEMBLY	7	81.1	3	41	45	60
3.6.4.3	OPTICAL PORTS	7	0.3	3	41	45	60
3.6.4.4	EQUIPMENT MOUNTING PORTS	7	9.0	3	41	45	60
3.6.4.5	ELECTRIC FIELD SUBASSEMBLY	7	19.8	3	41	45	60
3.6.4.6	OPTICAL CONDITIONING SUBASSEMBLY	7	12.9	3	41	45	60
3.6.4.7	ACOUSTICAL SUBASSEMBLY	7	9.0	3	41	45	60
3.6.4.8	LIGHT TRAPS	7	8.0	3	41	45	60
3.6.4.9	SCATTEROMETER INTERFACE						
	EQUIPMENT	7	4.0	3	41	45	60
3.6.4.10	THERMAL CONTROLLER	7	2.1	3	41	45	60
3.6.4.11	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	14.0	3	41	45	60
	TOTAL	6	374.7	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.5	EXPANSION CHAMBER ASSEMBLY						
3.6.5.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	221.6	3	41	45	60
3.6.5.2	CHAMBER WALL SUBASSEMBLY	7	139.9	3	41	45	60
3.6.5.3	OPTICAL PORTS	7	0.3	3	41	45	60
3.6.5.4	EQUIPMENT MOUNTING PORTS	7	7.0	3	41	45	60
3.6.5.5	ELECTRIC FIELD SUBASSEMBLY	7	19.7	3	41	45	60
3.6.5.6	OPTICAL HEATING SUBASSEMBLY	7	12.9	3	41	45	60
3.6.5.7	ACOUSTICAL SUBASSEMBLY	7	9.0	3	41	45	60
3.6.5.8	EXPANSION CONTROLLER SUBASSEMBLY	7	36.0	3	41	45	60
3.6.5.9	LIGHT TRAPS	7	4.0	3	41	45	60
3.5.5.10	SCATTEROMETER/INTERFACE						
	EQUIPMENT	7	4.0	3	41	45	60
3.6.5.11	THERMAL CONTROLLER	7	2.1	3	41	45	60
3.6.5.12	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	13.5	3	41	45	60
	TOTAL	6	470.0	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 32 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.6	CONTINUOUS FLOW DIFFUSION						
	CHAMBER ASSEMBLY						
3.6.6.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	149.5	3	41	45	60
3.6.6.2	CHAMBER PLATE SUBASSEMBLY	7	58.6	3	41	45	60
3.6.6.3	OPTICAL PORTS	7	0.2	3	41	45	60
3.6.6.4	WATER WICKING SURFACES	7	0.3	3	41	45	60
3.6.6.5	CARRIER AIR SUBASSEMBLY	7	5.3	3	41	45	60
3.6.6.6	SHEATH AIR SUBASSEMBLY	7	34.1	3	41	45	60
3.6.6.7	THERMAL CONTROLLERS	7	2.1	3	41	45	60
3.6.6.8	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	15.5	3	41	45	60
	TOTAL	6	265.6	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.7	EARTH SIMULATION CHAMBER						
	ASSEMBLY						
3.6.7.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	143.0	3	41	45	60
3.6.7.2	EARTH SIMULATION MODEL	7	82.5	3	41	45	60
3.6.7.3	ROTATING SUBASSEMBLY	7	82.0	3	41	45	60
3.6.7.4	HIGH VOLTAGE SUBASSEMBLY	7	17.7	3	41	45	60
3.6.7.5	FAN (MODEL COOLING)	7	0.7	3	41	45	60
3.6.7.6	OPTICAL COMPONENTS MOUNTING						
	SUBASSEMBLY	7	10.7	3	41	45	60
3.6.7.7	THERMAL CONTROLLERS	7	2.1	3	41	45	60
3.6.7.8	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	10.4	3	41	45	60
	TOTAL	6	349.1	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 34 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.6.8	NUCLEI CONDITIONING ASSEMBLY						
3.6.8.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	183.5	3	41	45	60
3.6.8.2	CHAMBER SUBASSEMBLY	7	38.1	3	41	45	60
3.6.8.3	AEROSOL CONDITIONING						
	SUBASSEMBLY	7	12.9	3	41	45	60
3.6.8.4	ACOUSTICAL SUBASSEMBLY	7	9.0	3	41	45	60
3.6.8.5	NUCLEI PRECONDITIONER						
	SUBASSEMBLY	7	12.6	3	41	45	60
3.6.8.6	VALVES	7	12.3	3	41	45	60
3.6.8.7	THERMAL CONTROLLER	7	2.1	3	41	45	60
3.6.8.8	INSTRUMENTATION AND DISPLAY						
	SUBASSEMBLY	7	8.7	3	41	45	60
	TOTAL	6	279.2	3	41	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 35 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.7	CONSOLE						
3.7.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	126.7	3	38	45	60
3.7.2	CONSOLE SUPPORT STURCTURE AND						
	SUBASSEMBLY	6	905.5	3	38	45	60
3.7.3	POWER CONTROL AND						
	DISTRIBUTION	6	147.2	3	38	45	60
3.7.4	CONSOLE PANELS AND DRAWER						
	SUBASSEMBLY	6	522.9	3	38	45	60
3.7.5	OVERHEAD STORAGE SUBASSEMBLY	6	0	3	38	45	60
3.7.6	FLOOR SEGMENT SUBASSEMBLY	6	0	3	38	45	60
3.7.7	INSTRUMENTATION/DISPLAYS	6	8.8	3	38	45	60
	TOTAL	5	1711.1	3	38	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.7.2.	CONSOLE SUPPORT STRUCTURE AND						
	SUBASSEMBLY						
3.7.2.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	67.1	3	38	45	60
3.7.2.2	MOD. STANDARD ERNO/.060M CAB.						
	STRUCT (SIDE CAB)	7	465.6	3	38	45	60
3.7.2.3	MOD. STNDRD. ERNO .572M CAB.						
	STRUCT (SIDE CAB)	7	372.8	3	38	45	60
	TOTAL	6	905.5	3	38	45	60
3.7.3	POWER CONTROL AND DISTRIBUTION						
3.7.3.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	7	27.5	3	38	45	60
3.7.3.2	28 VDC REGULATED CIRCUITS	7	67.9	3	38	45	60
3.7.3.3	110 VAC 3 400 HZ CIRCUIT	7	4.0	3	38	45	60
3.7.3.4	110 VAC/400 HZ CIRCUIT	7	1.0	3	38	45	60
3.7.3.5	110 VAC / 60 HZ CIRCUIT	7	41.8	3	38	45	60
3.7.3.6	INSTRUMENTATION	7	5.0	3	38	45	60
	TOTAL	6	147.2	3	38	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.8	OPTICAL DETECTION AND IMAGING						
	DEVICES						
3.8.1	INTEGRATION, ASSEMBLY, AND						
	CHECKOUT	6	176.9	3	42	45	60
3.8.2	CINE CAMERA	6	151.8	3	42	45	60
3.8.3	STILL CAMERA (35 mm)	6	77.4	3	42	45	60
3.8.4	MICROSCOPE TRINOCULAR	6	34.7	3	42	45	60
3.8.5	VIDEO CAMERA ASSEMBLY (16 mm)	6	73.4	3	42	45	60
3.8.6	LIGHT SOURCE	6	4.0	3	42	45	60
3.8.7	ANEMOMETER	6	505.5	3	42	45	60
3.8.8	STEREO MICROSCOPE	6	65.0	3	42	45	60
3.8.9	IR MICROSCOPE	6	1200.6	3	42	45	60
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES	6	83.1	3	42	45	60
3.8.11	DISPLAYS	6	15.0	3	42	45	60
	INITIAL SPARES						
	OPERATIONAL SPARES						
	TOTAL	5	2387.4	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 38 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES						
3.8.10.1	COUPLING OPTICS	7	77.4	3	42	45	60
3.8.10.2	EXPOSURE METER	7	2.1	3	42	45	60
3.8.10.3	SPOOLS	7	0	3	42	45	60
3.8.10.4	FILM (35 mm)	7	0	3	42	45	60
3.8.10.5	VIEWPORTS	7	3.6	3	42	45	60
	TOTAL	6	83.1	3	42	45	60
3.8.11	DISPLAYS						
3.8.11.1	DIGITAL	7	2.2	3	42	45	60
3.8.11.2	ANALOG	7	2.2	3	42	45	60
3.8.11.3	INDICATOR LIGHTS	7	0.5	3	42	45	60
3.8.11.4	CONTROLS	7	10.1	3	42	45	60
	TOTAL	6	15.0	3	42	45	60

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

PAGE 39 OF 44

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
5.0	SYSTEM TEST						
5.1	SYSTEM TEST PLANNING	5	28.8	3	42	45	40
5.2	MAJOR TEST ARTICLES	5	352.2	3	42	45	40
5.3	SYSTEMS DEVELOPMENT TESTING	5	81.6	3	42	45	40
5.4	SYSTEM VERIFICATION TESTING	5	95.2	3	42	45	40
	TOTAL	4	557.8	3	42	45	40

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM — A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
6.0	GROUND SUPPORT EQUIPMENT (GSE)						
6.1	GSE INTEGRATION	5	419.4	3	42	42	40
6.2	ELECTRICAL/ELECTRONIC GSE	5	286.3	3	42	42	40
6.3	MECHANICAL GSE	5	286.3	3	42	42	40
6.4	TRANSPORTATION AND HANDLING GSE	5	89.9	3	42	42	40
6.5	GSE SOFTWARE	5	151.0	3	42	42	40
6.6	GSE MAINTENANCE	5	0	3	42	42	40
	TOTAL	4	1232.9	3	42	42	40

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
8.0	LOGISTICS						
8.1	TRAINING	5	946.0	3	24	24	50
8.2	TRANSPORTATION AND HANDLING	5	5.0	3	24	24	50
8.3	INVENTORY CONTROL	5	10.6	3	24	24	50
	TOTAL	4	961.6	3	24	24	50

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/12/74

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
9.0	GROUND OPERATIONS						
9.1	RECOVERY OPERATIONS						
9.2	MAINTENANCE AND REFURBISHMENT						
	ACTIVITIES						
9.3	CHECKOUT OPERATIONS &						
	REFURBISHMENT FOR FLT						
9.4	LAUNCH OPERATIONS						
	TOTAL	4	0				

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
10.0	FLIGHT OPERATIONS						
10.1	MISSION PLANNING						
10.2	FLIGHT CONTROL AND EVALUATION						
	TOTAL	4	0				

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(1)

NONRECURRING (DDT&E)

DATE 9/12/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	EXPECTED COST	CONFIDENCE RATING	T_d	T_s	SPREAD FUNCTION
11.0	PRINCIPAL INVESTIGATOR (PI)						
	OPERATIONS						
11.1	PI PLANNING OPERATIONS						
11.2	PI PREFLIGHT OPERATIONS						
11.3	PI FLIGHT/POSTFLIGHT						
	OPERATIONS						
	TOTAL	4	0				

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

PAGE 1 OF 45

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
1.0	PROJECT MANAGEMENT	4			272.6			3	36	31	0	
2.0	SYSTEM ENGINEERING AND											
	INTEGRATION	4			589.1			3	36	31	40	
3.0	CLOUD PHYSICS EXPERIMENT											
	LABORATORY	4	2	3021.7	5960.7	1	3021.7	3	42	39	40	95
4.0	EXPERIMENT SUPPORT HARDWARE	4			0			3	-	-	-	
5.0	SYSTEM TEST	4			0			3	-	-	-	
6.0	GROUND SUPPORT EQUIPMENT (GSE)	4			54.1			3	12	18	0	
7.0	FACILITIES	4			0			3	-	-	-	
8.0	LOGISTICS	4			5.0			3	6	9	0	
9.0	GROUND OPERATIONS	4			0			3	-	-	-	
10.0	FLIGHT OPERATIONS	4			0			3	-	-	-	
11.0	PRINCIPAL INVESTIGATOR											
	OPERATIONS	4			0			3	-	-	-	
	TOTAL	3			6881.5			3				

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/13/74

PAGE 2 OF 45

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
2.0	SYSTEM ENGINEERING AND											
	INTEGRATION											
2.1	CPL/SPACELAB INTEGRATION	5			235.7			3	36	31	40	
2.2	CLOUD PHYSICS LABORATORY	5			176.7			3	36	31	40	
2.3	EXPERIMENT SUPPORT	5			58.9			3	36	31	40	
2.4	GROUND SUPPORT EQUIPMENT	5			58.9			3	36	31	40	
2.5	SAFETY, RELIABILITY & QUALITY											
	ASSURANCE	5			58.9			3	36	31	40	
	TOTAL	4		N/A	589.1	N/A	N/A	3	36	31	40	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

PAGE 3 OF 45

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.0	CLOUD PHYSICS EXPERIMENT											
	LABORATORY											
3.1	FINAL ASSEMBLY, INTEGRATION &											
	CHECKOUT	5	2	143.9	273.4	1	143.9	3	21	19	50	95
3.2	THERMAL CONTROL/EXPENDABLES											
	STOR. & CONT.	5	2	434.4	863.6	1	434.4	3	36	39	40	95
3.3	PARTICLE GENERATORS	5	2	179.7	356.8	1	179.7	3	36	39	40	95
3.4	DATA MANAGEMENT	5	2	398.4	791.3	1	398.4	3	36	39	40	95
3.5	PARTICLE DETECTORS AND											
	CHARACTERIZERS	5	2	389.7	773.8	1	389.7	3	36	39	40	95
3.6	EXPERIMENT CHAMBERS	5	2	750.9	1491.8	1	750.9	3	36	39	40	95
3.7	CONSOLE	5	2	413.6	791.9	1	413.6	3	33	39	40	95
3.8	OPTICAL DETECTION AND IMAGING											
	DEVICES	5	2	311.1	618.1	1	311.1	3	36	39	40	95
	TOTAL	4	2	3021.7	5960.7	1	3021.7	3	42	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.2	THERMAL CONTROL/EXPENDABLES											
	STOR. & CONT.											
3.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	32.2	61.2	1	32.2	3	36	39	40	95
3.2.2	THERMAL CONTROL	6	2	128.9	244.9	1	128.9	3	36	39	40	95
3.2.3	FLOW, HUMIDITY, AND PRESSURE											
	CONTROL	6	2	74.6	141.8	1	74.6	3	36	39	40	95
3.2.4	EXPENDABLES STORAGE	6	2	71.5	135.9	1	71.5	3	36	39	40	95
3.2.5	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	6	2	107.6	204.9	1	107.6	3	36	39	40	95
3.2.6	EXPENDABLES	6	2	0	0	1	0	3	36	39	40	95
3.2.7	CLEANSING, PURGE, AND VENT											
	SUBASSEMBLY	6	2	19.6	37.2	1	19.6	3	36	39	40	95
	INITIAL SPARES	6	2		37.7	1		3	36	39	40	95
	OPERATIONAL SPARES	6	2		-	1		3	36	39	40	95
	TOTAL	5	2	434.4	863.6	1	434.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.2.2	THERMAL CONTROL											
3.2.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	9.5	18.1	1	9.5	3	36	39	40	95
3.2.2.2	CLOUD CHAMBER COOLING											
	SUBASSEMBLY	7	2	114.2	217.0	1	114.2	3	36	39	40	95
3.2.2.3	SUPPORT EQUIPMENT COOLING											
	SUBASSEMBLY	7	2	5.2	9.8	1	5.2	3	36	39	40	95
	TOTAL	6	2	128.9	244.9	1	128.9	3	36	39	40	95
3.2.3	FLOW, HUMIDITY, AND PRESSURE											
	CONTROL											
3.2.3.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	5.5	10.5	1	5.5	3	36	39	40	95
3.2.3.2	HUMIDIFICATION SUBASSEMBLY	7	2	46.3	87.9	1	46.3	3	36	39	40	95
3.2.3.3	WATER STORAGE AND SUPPLY											
	SUBASSEMBLY	7	2	22.8	43.4	1	22.8	3	36	39	40	95
	TOTAL	6	2	74.6	141.8	1	74.6	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.2.4	EXPENDABLES STORAGE											
3.2.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	5.3	10.1	1	5.3	3	36	39	40	95
3.2.4.2	DRY AIR STORAGE SUBASSEMBLY	7	2	37.8	71.8	1	37.8	3	36	39	40	95
3.2.4.3	SAMPLE GAS STORAGE SUBASSEMBLY	7	2	28.4	54.0	1	28.4	3	36	39	40	95
	TOTAL	6	2	71.5	135.9	1	71.5	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.2.5	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY											
3.2.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	8.0	15.2	1	8.0	3	36	39	40	95
3.2.5.2	TEMPERATURE SENSORS	7	2	12.9	24.6	1	12.9	3	36	39	40	95
3.2.5.3	PRESSURE SENSORS	7	2	86.9	165.1	1	86.9	3	36	39	40	95
3.2.5.4	VISUAL DISPLAYS (NOT INCLUDED											
	HERE)	7	2	0	0	1	0	3	36	39	40	95
	TOTAL	6	2	107.6	204.9	1	107.6	3	36	39	40	95
3.2.6	EXPENDABLES											
3.2.6.1	INTEGRATION, ASSEMBLY AND											
	CHECKOUT	7	2	0	0	1	0	3	36	39	40	95
3.2.6.2	AIR	7	2	0	0	1	0	3	36	39	40	95
3.2.6.3	SAMPLE GASES	7	2	0	0	1	0	3	36	39	40	95
3.2.6.4	WATER	7	2	0	0	1	0	3	36	39	40	95
	TOTAL	6	2	0	0	1	0	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.2.7	CLEANSING, PURGE, AND VENT											
	SUBASSEMBLY											
3.2.7.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.5	2.8	1	1.5	3	36	39	40	95
3.2.7.2	VALVES	7	2	7.8	14.9	1	7.8	3	36	39	40	95
3.2.7.3	FILTERS	7	2	4.5	8.6	1	4.5	3	36	39	40	95
3.2.7.4	DISTRIBUTION PLUMBING	7	2	5.7	10.9	1	5.7	3	36	39	40	95
	TOTAL	6	2	19.6	37.2	1	19.6	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3	PARTICLE GENERATORS											
3.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT	6	2	13.3	25.3	1	13.3	3	36	39	40	95
3.3.2	WIRE PROBE RETRACTOR GENERATOR	6	2	20.3	38.6	1	20.3	3	36	39	40	95
3.3.3	WATER DROP IMPELLER GENERATOR	6	2	6.8	12.9	1	6.8	3	36	39	40	95
3.3.4	VIBRATING ORIFICE GENERATOR	6	2	41.9	79.6	1	41.9	3	36	39	40	95
3.3.5	EVAPORATOR/CONDENSER GENERATOR	6	2	17.4	33.0	1	17.4	3	36	39	40	95
3.3.6	SPRAY ATOMIZER GENERATOR	6	2	8.3	15.7	1	8.3	3	36	39	40	95
3.3.7	POWDER DISPERSION GENERATOR	6	2	6.1	11.5	1	6.1	3	36	39	40	95
3.3.8	PARTICLE INJECTOR & SIZE CONDITIONER	6	2	55.3	105.1	1	55.3	3	36	39	40	95
3.3.9	INSTRUMENTATION/DISPLAYS	6	2	10.3	19.5	1	10.3	3	36	39	40	95
	INITIAL SPARES				15.6							
	OPERATIONAL SPARES				-							
	TOTAL	5	2	179.7	356.8	1	179.7	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3.2	WIRE PROBE RETRACTOR GENERATOR											
3.3.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.3	0.6	1	0.3	3	36	39	40	95
3.3.2.2	DUAL PULSE GENERATOR	7	2	13.4	25.4	1	13.4	3	36	39	40	95
3.3.2.3	SWITCH	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.3.2.4	HIGH VOLTAGE PULSE GENERATOR	7	2	4.3	8.1	1	4.3	3	36	39	40	95
3.3.2.5	LINEAR ACTUATOR	7	2	1.2	2.2	1	1.2	3	36	39	40	95
3.3.2.6	WIRE PROBE RETRACTOR	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.3.2.7	VALVE	7	2	0.7	1.3	1	0.7	3	36	39	40	95
	TOTAL	6	2	20.5	38.6	1	20.5	3	36	39	40	95
3.3.3	WATER DROP IMPELLER GENERATOR											
3.3.3.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.5	1.0	1	0.5	3	36	39	40	95
3.3.3.2	HIGH VOLTAGE PULSE GENERATOR	7	2	4.2	8.0	1	4.2	3	36	39	40	95
3.3.3.3	SWITCH	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.3.3.4	SOLENOID DRIVER	7	2	1.1	2.0	1	1.1	3	36	39	40	95
3.3.3.5	WATER DROP IMPELLER	7	2	0.3	0.6	1	0.3	3	36	39	40	95
3.3.3.6	VALVE	7	2	0.6	1.2	1	0.6	3	36	39	40	95
	TOTAL	6	2	6.8	12.9	1	6.8	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3.4	VIBRATING ORIFICE GENERATOR											
3.3.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	3.1	5.9	1	3.1	3	36	39	40	95
3.3.4.2	FREQUENCY GENERATOR	7	2	7.5	14.3	1	7.5	3	36	39	40	95
3.3.4.3	POSITIVE DISPLACEMENT PUMP	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.3.4.4	VIBRATING ORIFICE	7	2	25.2	47.9	1	25.2	3	36	39	40	95
3.3.4.5	VALVE	7	2	1.7	3.3	1	1.7	3	36	39	40	95
3.3.4.6	FLOW CONTROLLER	7	2	2.7	5.2	1	2.7	3	36	39	40	95
	TOTAL	6	2	41.8	79.6	1	41.8	3	36	39	40	95
3.3.5	EVAPORATOR/CONDENSER											
	GENERATOR											
3.3.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.3	2.4	1	1.3	3	36	39	40	95
3.3.5.2	EVAPORATOR FURNACE	7	2	7.2	13.6	1	7.2	3	36	39	40	95
3.3.5.3	CONDENSER	7	2	4.3	8.2	1	4.3	3	36	39	40	95
3.3.5.4	THERMAL CONTROLLER	7	2	1.1	2.0	1	1.1	3	36	39	40	95
3.3.5.5	FLOW CONTROLLER	7	2	1.9	3.7	1	1.9	3	36	39	40	95
3.3.5.6	VALVE	7	2	1.6	3.1	1	1.6	3	36	39	40	95
	TOTAL	6	2	17.4	33.0	1	17.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3.6	SPRAY ATOMIZER GENERATOR											
3.3.6.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.6	1.2	1	0.6	3	36	39	40	95
3.3.6.2	POSITIVE DISPLACEMENT PUMP	7	2	1.4	2.7	1	1.4	3	36	39	40	95
3.3.6.3	SPRAY ATOMIZER	7	2	2.2	4.2	1	2.2	3	36	39	40	95
3.3.6.4	FLOW CONTROLLER	7	2	1.8	3.5	1	1.8	3	36	39	40	95
3.3.6.5	VALVE	7	2	2.2	4.1	1	2.2	3	36	39	40	95
	TOTAL	6	2	8.2	15.7	1	8.2	3	36	39	40	95
3.3.7	POWDER DISPERSION GENERATOR											
3.3.7.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.3.7.2	POWDER DISPERSER	7	2	2.2	4.2	1	2.2	3	36	39	40	95
3.3.7.3	FLOW CONTROLLER	7	2	1.8	3.4	1	1.8	3	36	39	40	95
3.3.7.4	VALVE	7	2	1.6	3.0	1	1.6	3	36	39	40	95
	TOTAL	6	2	6.1	11.5	1	6.1	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3.8	PARTICLE INJECTOR & SIZE											
	CONDITIONER											
3.3.8.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	27.7	52.6	1	27.7	3	36	39	40	95
3.3.8.2	CONDITIONER WALL SUBASSEMBLY	7	2	13.2	25.1	1	13.2	3	36	39	40	95
3.3.8.3	OPTICAL PORTS	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.3.8.4	EQUIPMENT MOUNTING PORTS	7	2	1.5	2.8	1	1.5	3	36	39	40	95
3.3.8.5	WATER WICKING SURFACE	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.3.8.6	ACOUSTICAL SUBASSEMBLY	7	2	3.4	6.5	1	3.4	3	36	39	40	95
3.3.8.7	THERMAL CONTROLLER	7	2	1.6	3.1	1	1.6	3	36	39	40	95
3.3.8.8	VELOCITY CONTROLLER	7	2	4.0	7.6	1	4.0	3	36	39	40	95
3.3.8.9	SHUTTER VALVE	7	2	0.4	0.8	1	0.4	3	36	39	40	95
3.3.8.10	VALVES	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.3.8.11	INSTRUMENTATION AND DISPLAY	7	2	2.8	5.4	1	2.8	3	36	39	40	95
	TOTAL	6	2	55.3	105.1	1	55.3	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.3.9	INSTRUMENTATION/DISPLAYS											
3.3.9.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.8	1.5	1	0.8	3	36	39	40	95
3.3.9.2	VOLTAGE SENSORS	7	2	2.4	4.5	1	2.4	3	36	39	40	95
3.3.9.3	TEMPERATURE SENSORS	7	2	0.4	0.7	1	0.4	3	36	39	40	95
3.3.9.4	AIR FLOW SENSORS	7	2	3.2	6.0	1	3.2	3	36	39	40	95
3.3.9.5	POSITION SENSORS	7	2	0.5	1.0	1	0.5	3	36	39	40	95
3.3.9.6	FREQUENCY SENSORS	7	2	2.5	4.7	1	2.5	3	36	39	40	95
3.3.9.7	DISPLAYS	7	2	0.6	1.1	1	0.6	3	36	39	40	95
	TOTAL	6	2	10.4	19.5	1	10.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.4	DATA MANAGEMENT											
3.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	29.5	56.0	1	29.5	3	36	39	40	95
3.4.2	CONTROL PROCESSOR ASSEMBLY	6	2	96.9	184.0	1	96.9	3	36	39	40	95
3.4.3	TAPE RECORDER ASSEMBLY	6	2	0	0	1	0	3	36	39	40	95
3.4.4	MASTER CONTROL ASSEMBLY	6	2	14.9	28.4	1	14.9	3	36	39	40	95
3.4.5	SIGNAL CONDITIONING ELECTRONICS											
	ASSEMBLY	6	2	129.2	245.3	1	129.2	3	36	39	40	95
3.4.6	INSTRUMENTATION AND DISPLAY											
	ASSEMBLY	6	2	94.7	180.0	1	94.7	3	36	39	40	95
3.4.7	EXPENDABLES	6	2	0	0	1	0	3	36	39	40	95
3.4.8	CABLE ASSEMBLIES	6	2	33.2	63.1	1	33.2	3	36	39	40	95
	INITIAL SPARES	6	2		34.5	1		3	36	39	40	95
	OPERATIONAL SPARES				-							
	TOTAL	5	2	398.4	791.3	1	398.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.4.2	CONTROL PROCESSOR ASSEMBLY											
3.4.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	7.2	13.6	1	7.2	3	36	39	40	95
3.4.2.2	CONTROL PROCESSOR	7	2	66.9	127.1	1	66.9	3	36	39	40	95
3.4.2.3	SOFTWARE	7	2	0	0	1	0	3	36	39	40	95
3.4.2.4	CONTROL UNITS	7	2	22.8	43.3	1	22.8	3	36	39	40	95
	TOTAL	6	2	96.9	184.0	1	96.9	3	36	39	40	95
3.4.4	MASTER CONTROL ASSEMBLY											
3.4.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.1	2.1	1	1.1	3	36	39	40	95
3.4.4.2	KEYBOARD	7	2	0.8	1.6	1	0.8	3	36	39	40	95
3.4.4.3	DISCRETE CONTROLS	7	2	13.0	24.7	1	13.0	3	36	39	40	95
	TOTAL	6	2	14.9	28.4	1	14.9	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/13/74

PAGE 17 OF 45

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.4.5	SIGNAL CONDITIONING ELECTRONICS											
	ASSEMBLY											
3.4.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	9.6	18.2	1	9.6	3	36	39	40	95
3.4.5.2	ANALOG CONDITIONING ELECTRONICS	7	2	11.6	22.0	1	11.6	3	36	39	40	95
3.4.5.3	DIGITAL CONDITIONING ELECTRONICS	7	2	11.6	22.0	1	11.6	3	36	39	40	95
3.4.5.4	FORMATTER	7	2	95.7	181.8	1	95.7	3	36	39	40	95
3.4.5.5	RAU	7	2	0	0	1	0	3	36	39	40	95
3.4.5.6	INTERCOM	7	2	0.7	1.3	1	0.7	3	36	39	40	95
3.4.5.7	CAUTION/WARNING ELECTRONICS	7	2	0	0	1	0	3	36	39	40	95
	TOTAL	6	2	129.2	245.3	1	129.2	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.4.6	INSTRUMENTATION AND DISPLAY											
	ASSEMBLY											
3.4.6.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	7.0	13.4	1	7.0	3	36	39	40	95
3.4.6.2	INSTRUMENTATION	7	2	16.3	31.0	1	16.3	3	36	39	40	95
3.4.6.3	VIDEO MONITOR	7	2	1.4	2.7	1	1.4	3	36	39	40	95
3.4.6.4	GRAPHICS DISPLAY UNIT	7	2	53.4	101.4	1	53.4	3	36	39	40	95
3.4.6.5	SEQUENCE DISPLAY UNIT	7	2	12.7	24.1	1	12.7	3	36	39	40	95
3.4.6.6	TIME DISPLAY	7	2	3.9	7.4	1	3.9	3	36	39	40	95
	TOTAL	6	2	94.7	180.0	1	94.7	3	36	39	40	95
3.4.8	CABLE ASSEMBLIES	6	2	33.2	63.1	1	33.2	3	36	39	40	95

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5	PARTICLE DETECTORS AND											
	CHARACTERIZERS											
3.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	28.8	54.8	1	28.8	3	36	39	40	95
3.5.2	OPTICAL PARTICLE COUNTER	6	2	23.8	45.3	1	23.8	3	36	39	40	95
3.5.3	PULSE HEIGHT ANALYZER	6	2	8.1	15.5	1	8.1	3	36	39	40	95
3.5.4	CONDENSATION NUCLEUS COUNTER	6	2	18.4	35.0	1	18.4	3	36	39	40	95
3.5.5	MICROPOROUS FILTER	6	2	5.0	9.2	1	5.0	3	36	39	40	95
3.5.6	QUARTZ CRYSTAL MASS MONITOR	6	2	22.7	42.9	1	22.7	3	36	39	40	95
3.5.7	CASCADE IMPACTOR	6	2	6.4	11.9	1	6.4	3	36	39	40	95
3.5.8	ELECTRICAL AEROSOL SIZE											
	ANALYZER	6	2	82.7	157.3	1	82.7	3	36	39	40	95
3.5.9	SCATTEROMETER	6	2	31.4	59.7	1	31.4	3	36	39	40	95
3.5.10	LIQUID WATER CONTENT METER	6	2	27.1	51.5	1	27.1	3	36	39	40	95
3.5.11	DROPLET SIZE DISTRIBUTION METER	6	2	83.6	159.0	1	83.6	3	36	39	40	95
3.5.12	OPTICAL THERMOELECTRIC DEW											
	POINT HYGROMETER	6	2	31.3	59.4	1	31.3	3	36	39	40	95
3.5.13	ELECTRIC DEW POINT HYGROMETER	6	2	3.5	6.6	1	3.5	3	36	39	40	95
3.5.14	INSTRUMENTATION/DISPLAYS	6	2	16.9	32.0	1	16.9	3	36	39	40	95
	INITIAL SPARES	6	2		33.7	1		3	36	39	40	95
	OPERATIONAL SPARES				-							
	TOTAL	5	2	389.7	773.8	1	389.7	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.2	OPTICAL PARTICLE COUNTER											
3.5.2.1	INTEGRATION, ASSEMBLY AND											
	CHECKOUT	7	2	1.7	3.3	1	1.7	3	36	39	40	95
3.5.2.2	SENSOR	7	2	6.8	12.9	1	6.8	3	36	39	40	95
3.5.2.3	PARTICLE COUNTER	7	2	11.8	22.4	1	11.8	3	36	39	40	95
3.5.2.4	VACUUM PUMP	7	2	0	0	1	0	3	36	39	40	95
3.5.2.5	VALVE	7	2	1.9	3.6	1	1.9	3	36	39	40	95
3.5.2.6	FLOW CONTROLLER	7	2	1.6	3.1	1	1.6	3	36	39	40	95
	TOTAL	6	2	23.8	45.3	1	23.8	3	36	39	40	95
3.5.3	PULSE HEIGHT ANALYZER											
3.5.3.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.6	1.2	1	0.6	3	36	39	40	95
3.5.3.2	ANALYZER WITH READOUT	7	2	6.6	12.5	1	6.6	3	36	39	40	95
3.5.3.3	OSCILLOSCOPE	7	2	0.9	1.8	1	0.9	3	36	39	40	95
	TOTAL	6	2	8.1	15.5	1	8.1	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.4	CONDENSATION NUCLEUS COUNTER											
3.5.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.4	2.6	1	1.4	3	36	39	40	95
3.5.4.2	COUNTER CONTROL	7	2	11.9	22.7	1	11.9	3	36	39	40	95
3.5.4.3	VALVE	7	2	2.3	4.3	1	2.3	3	36	39	40	95
3.5.4.4	POSITIVE DISPLACEMENT PUMP	7	2	1.0	1.9	1	1.0	3	36	39	40	95
3.5.4.5	VACUUM PUMP	7	2	0.2	0.4	1	0.2	3	36	39	40	95
3.5.4.6	FLOW CONTROLLER	7	2	1.6	3.1	1	1.6	3	36	39	40	95
	TOTAL	6	2	18.4	35.0	1	18.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.5	MICROPOROUS FILTER											
3.5.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.4	0.7	1	0.4	3	36	39	40	95
3.5.5.2	FILTER HOUSING	7	2	0.2	0.3	1	0.2	3	36	39	40	95
3.5.5.3	VACUUM PUMP	7	2	0.2	0.4	1	0.2	3	36	39	40	95
3.5.5.4	FILTER STORAGE CONTAINER	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.5.5.5	NUCLEI SAMPLE FILTERS	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.5.5.6	VALVE	7	2	1.6	3.1	1	1.6	3	36	39	40	95
3.5.5.7	FLOW CONTROLLER	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.5.5.8	TIMER/CLOCK CONTROL	7	2	0.4	0.7	1	0.4	3	36	39	40	95
	TOTAL	6	2	5.0	9.2	1	5.0	3	36	39	40	95
3.5.6	QUARTZ CRYSTAL MASS MONITOR											
3.5.6.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.7	3.2	1	1.7	3	36	39	40	95
3.5.6.2	PARTICLE MASS MONITOR	7	2	18.1	34.3	1	18.1	3	36	39	40	95
3.5.6.3	FLOW CONTROLLER	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.5.6.4	VALVE	7	2	1.1	2.0	1	1.1	3	36	39	40	95
3.5.6.5	VACUUM PUMP	7	2	0.2	0.4	1	0.2	3	36	39	40	95
	TOTAL	6	2	22.7	42.9	1	22.7	3	36	39	40	95

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.7	CASCADE IMPACTOR											
3.5.7.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.5.7.2	CASCADE IMPACTOR HOUSING	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.5.7.3	VACUUM PUMP	7	2	0.2	0.4	1	0.2	3	36	39	40	95
3.5.7.4	SLIDE STORAGE CONTAINER	7	2	0.5	0.9	1	0.5	3	36	39	40	95
3.5.7.5	SLIDES	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.5.7.6	FLOW CONTROLLER	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.5.7.7	VALVE	7	2	1.6	3.0	1	1.6	3	36	39	40	95
3.5.7.8	TIMER/CLOCK CONTROLLER	7	2	0.3	0.6	1	0.3	3	36	39	40	95
	TOTAL	6	2	6.4	11.9	1	6.4	3	36	39	40	95
3.5.8	ELECTRICAL AEROSOL SIZE											
	ANALYZER											
3.5.8.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	6.1	11.6	1	6.1	3	36	39	40	95
3.5.8.2	FLOW MODULE	7	2	70.2	133.4	1	70.2	3	36	39	40	95
3.5.8.3	CONTROL CIRCUIT/READOUT	7	2	0	0	1	0	3	36	39	40	95
3.5.8.4	VACUUM PUMP	7	2	0.2	0.4	1	0.2	3	36	39	40	95
3.5.8.5	FLOW CONTROLLER	7	2	4.7	9.0	1	4.7	3	36	39	40	95
3.5.8.6	VALVE	7	2	1.5	2.9	1	1.5	3	36	39	40	95
	TOTAL	6	2	82.7	157.3	1	82.7	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.9	SCATTEROMETER											
3.5.9.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	2.3	4.4	1	2.3	3	36	39	40	95
3.5.9.2	PHOTO DETECTOR	7	2	0.4	0.8	1	0.4	3	36	39	40	95
3.5.9.3	INDEXING MOUNT	7	2	10.0	19.0	1	10.0	3	36	39	40	95
3.5.9.4	LASER LIGHT SOURCE	7	2	6.7	12.7	1	6.7	3	36	39	40	95
3.5.9.5	ELECTRONICS AND CONTROLS	7	2	12.0	22.8	1	12.0	3	36	39	40	95
	TOTAL	6	2	31.4	59.7	1	31.4	3	36	39	40	95
3.5.10	LIQUID WATER CONTENT METER											
3.5.10.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	2.0	3.8	1	2.0	3	36	39	40	95
3.5.10.2	PHOTO DETECTOR	7	2	1.1	2.1	1	1.1	3	36	39	40	95
3.5.10.3	LASER LIGHT SOURCE	7	2	6.0	11.4	1	6.0	3	36	39	40	95
3.5.10.4	ELECTRONICS AND CONTROLS	7	2	18.0	34.2	1	18.0	3	36	39	40	95
	TOTAL	6	2	27.1	51.5	1	27.1	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.11	DROPLET SIZE DISTRIBUTION METER											
3.5.11.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	6.2	11.8	1	6.2	3	36	39	40	95
3.5.11.2	PHOTO DETECTOR	7	2	21.1	40.1	1	21.1	3	36	39	40	95
3.5.11.3	LASER LIGHT SOURCE	7	2	5.7	10.9	1	5.7	3	36	39	40	95
3.5.11.4	ELECTRONICS AND CONTROLS	7	2	50.6	96.2	1	50.6	3	36	39	40	95
	TOTAL	6	2	83.6	159.0	1	83.6	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.12	OPTICAL THERMOELECTRIC DEW											
	POINT HYGROMETER											
3.5.12.1	INSTALLATION, ASSEMBLY, AND											
	CHECKOUT	7	2	2.3	4.4	1	2.3	3	36	39	40	95
3.5.12.2	SENSOR	7	2	26.4	50.1	1	26.4	3	36	39	40	95
3.5.12.3	SENSING UNIT	7	2	0	0	1	0	3	36	39	40	95
3.5.12.4	READOUT	7	2	0	0	1	0	3	36	39	40	95
3.5.12.5	VALVE	7	2	1.0	1.9	1	1.0	3	36	39	40	95
3.5.12.6	FLOW CONTROLLER	7	2	1.6	3.0	1	1.6	3	36	39	40	95
	TOTAL	6	2	31.3	59.4	1	31.3	3	36	39	40	95
3.5.13	ELECTRIC DEW POINT HYGROMETER											
3.5.13.1	INSTALLATION, ASSEMBLY, AND											
	CHECKOUT	7	2	0.3	0.5	1	0.3	3	36	39	40	95
3.5.13.2	DEW POINT HYDGROMETER	7	2	2.9	5.6	1	2.9	3	36	39	40	95
3.5.13.3	SENSOR	7	2	0.3	0.5	1	0.3	3	36	39	40	95
	TOTAL	6	2	3.5	6.6	1	3.5	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.5.14	INSTRUMENTATION/DISPLAYS											
3.5.14.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	1.3	2.4	1	1.3	3	36	39	40	95
3.5.14.2	VOLTAGE SENSORS	7	2	2.2	4.2	1	2.2	3	36	39	40	95
3.5.14.3	CURRENT SENSORS	7	2	1.7	3.3	1	1.7	3	36	39	40	95
3.5.14.4	TEMPERATURE SENSORS	7	2	0.3	0.5	1	0.3	3	36	39	40	95
3.5.14.5	AIR FLOW SENSORS	7	2	5.0	9.5	1	5.0	3	36	39	40	95
3.5.14.6	PRESSURE SENSORS	7	2	2.4	4.5	1	2.4	3	36	39	40	95
3.5.14.7	FREQUENCY SENSORS	7	2	2.3	4.3	1	2.3	3	36	39	40	95
3.5.14.8	DISPLAYS	7	2	1.7	3.3	1	1.7	3	36	39	40	95
	TOTAL	6	2	16.9	32.0	1	16.9	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6	EXPERIMENT CHAMBERS											
3.6.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	55.6	105.7	1	55.6	3	36	39	40	95
3.6.2	STATIC DIFFUSION LIQUID CHAMBER											
	ASSEMBLY	6	2	51.7	98.3	1	51.7	3	36	39	40	95
3.6.3	STATIC DIFFUSION ICE CHAMBER											
	ASSEMBLY	6	2	122.6	232.7	1	122.6	3	36	39	40	95
3.6.4	GENERAL CHAMBER ASSEMBLY	6	2	131.4	249.6	1	131.4	3	36	39	40	95
3.6.5	EXPANSION CHAMBER ASSEMBLY	6	2	198.3	377.0	1	198.3	3	36	39	40	95
3.6.6	CONTINUOUS FLOW DIFFUSION											
	ASSEMBLY	6	2	69.1	131.5	1	69.1	3	36	39	40	95
3.6.7	EARTH SIMULATION CHAMBER											
	ASSEMBLY	6	2	53.2	101.1	1	53.2	3	36	39	40	95
3.6.8	NUCLEI CONDITIONING ASSEMBLY	6	2	69.0	130.9	1	69.0	3	36	39	40	95
	INITIAL SPARES	6	2		65.0	1		3	36	39	40	95
	OPERATIONAL SPARES				-							
	TOTAL	5	2	750.9	1491.8	1	750.9	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.2	STATIC DIFFUSION LIQUID CHAMBER											
	ASSEMBLY											
3.6.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	25.9	49.2	1	25.9	3	36	39	40	95
3.6.2.2	CHAMBER WALL SUBASSEMBLY	7	2	16.6	31.6	1	16.6	3	36	39	40	95
3.6.2.3	OPTICAL PORTS	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.2.4	EQUIPMENT MOUNTING PORTS	7	2	1.4	2.6	1	1.4	3	36	39	40	95
3.6.2.5	WATER WICKING SURFACES	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.2.6	LIGHT TRAP	7	2	2.8	5.3	1	2.8	3	36	39	40	95
3.6.2.7	THERMAL CONTROLLERS	7	2	0.9	1.8	1	0.9	3	36	39	40	95
3.6.2.8	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	3.9	7.4	1	3.9	3	36	39	40	95
	TOTAL	6	2	51.7	98.3	1	51.7	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.3	STATIC DIFFUSION ICE CHAMBER											
	ASSEMBLY											
3.6.3.1	INTEGRATION, ASSEMBLY, AND											
-	CHECKOUT	7	2	61.3	116.4	1	61.3	3	36	39	40	95
3.6.3.2	CHAMBER WALL SUBASSEMBLY	7	2	25.9	49.2	1	25.9	3	36	39	40	95
3.6.3.3	OPTICAL PORTS	7	2	0.2	0.3	1	0.2	3	36	39	40	95
3.6.3.4	EQUIPMENT MOUNTING PORTS	7	2	3.6	6.8	1	3.6	3	36	39	40	95
3.6.3.5	WATER WICKING SURFACES	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.3.6	ELECTRIC FIELD SUBASSEMBLY	7	2	9.3	17.6	1	9.3	3	36	39	40	95
3.6.3.7	OPTICAL CONDITIONING SUBASSEMBLY	7	2	6.2	11.8	1	6.2	3	36	39	40	95
3.6.3.8	ACOUSTICAL SUBASSEMBLY	7	2	4.1	7.8	1	4.1	3	36	39	40	95
3.6.3.9	SCATTEROMETER INTERFACE											
	EQUIPMENT	7	2	2.0	3.8	1	2.0	3	36	39	40	95
3.6.3.10	LIGHT TRAPS	7	2	3.3	6.2	1	3.3	3	36	39	40	95
3.6.3.11	THERMAL CONTROLLERS	7	2	1.8	3.4	1	1.8	3	36	39	40	95
3.6.3.12	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	4.8	9.2	1	4.8	3	36	39	40	95
	TOTAL	6	2	122.6	232.7	1	122.6	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.4	GENERAL CHAMBER ASSEMBLY											
3.6.4.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	65.7	124.8	1	65.7	3	36	39	40	95
3.6.4.2	CHAMBER WALL SUBASSEMBLY	7	2	33.0	62.7	1	33.0	3	36	39	40	95
3.6.4.3	OPTICAL PORTS	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.4.4	EQUIPMENT MOUNTING PORTS	7	2	3.4	6.4	1	3.4	3	36	39	40	95
3.6.4.5	ELECTRIC FIELD SUBASSEMBLY	7	2	8.6	16.4	1	8.6	3	36	39	40	95
3.6.4.6	OPTICAL CONDITIONING SUBASSEMBLY	7	2	5.7	10.9	1	5.7	3	36	39	40	95
3.6.4.7	ACOUSTICAL SUBASSEMBLY	7	2	3.7	7.1	1	3.7	3	36	39	40	95
3.6.4.8	LIGHT TRAPS	7	2	3.2	6.0	1	3.2	3	36	39	40	95
3.6.4.9	SCATTEROMETER INTERFACE											
	EQUIPMENT	7	2	1.8	3.4	1	1.8	3	36	39	40	95
3.6.4.10	THERMAL CONTROLLER	7	2	0.9	1.7	1	0.9	3	36	39	40	95
3.6.4.11	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	5.3	10.0	1	5.3	3	36	39	40	95
	TOTAL	6	2	131.4	249.6	1	131.4	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.5	EXPANSION CHAMBER ASSEMBLY											
3.6.5.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	99.2	188.5	1	99.2	3	36	39	40	95
3.6.5.2	CHAMBER WALL SUBASSEMBLY	7	2	53.7	102.1	1	53.7	3	36	39	40	95
3.6.5.3	OPTICAL PORTS	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.5.4	EQUIPMENT MOUNTING PORTS	7	2	2.6	4.9	1	2.6	3	36	39	40	95
3.6.5.5	ELECTRIC FIELD SUBASSEMBLY	7	2	8.4	15.9	1	8.4	3	36	39	40	95
3.6.5.6	OPTICAL HEATING SUBASSEMBLY	7	2	5.5	10.5	1	5.5	3	36	39	40	95
3.6.5.7	ACOUSTICAL SUBASSEMBLY	7	2	3.6	6.8	1	3.6	3	36	39	40	95
3.6.5.8	EXPANSION CONTROLLER											
	SUBASSEMBLY	7	2	16.2	30.8	1	16.2	3	36	39	40	95
3.6.5.9	LIGHT TRAPS	7	2	1.5	2.9	1	1.5	3	36	39	40	95
3.6.5.10	SCATTEROMETER/INTERFACE											
	EQUIPMENT	7	2	1.7	3.3	1	1.7	3	36	39	40	95
3.6.5.11	THERMAL CONTROLLER	7	2	0.8	1.6	1	0.8	3	36	39	40	95
3.6.5.12	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	5.0	9.5	1	5.0	3	36	39	40	95
	TOTAL	6	2	198.3	377.0	1	198.3	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.6	CONTINUOUS FLOW DIFFUSION											
	CHAMBER ASSEMBLY											
3.6.6.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	34.6	65.8	1	34.6	3	36	39	40	95
3.6.6.2	CHAMBER PLATE SUBASSEMBLY	7	2	22.1	42.0	1	22.1	3	36	39	40	95
3.6.6.3	OPTICAL PORTS	7	2	0.1	0.1	1	0.1	3	36	39	40	95
3.6.6.4	WATER WICKING SURFACES	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.6.5	CARRIER AIR SUBASSEMBLY	7	2	1.9	3.7	1	1.9	3	36	39	40	95
3.6.6.6	SHEATH AIR SUBASSEMBLY	7	2	3.7	7.1	1	3.7	3	36	39	40	95
3.6.6.7	THERMAL CONTROLLERS	7	2	0.8	1.6	1	0.8	3	36	39	40	95
3.6.6.8	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	5.8	11.0	1	5.8	3	36	39	40	95
	TOTAL	6	2	69.1	131.5	1	69.1	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.7	EARTH SIMULATION CHAMBER											
	ASSEMBLY											
3.6.7.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	26.6	50.5	1	26.6	3	36	39	40	95
3.6.7.2	EARTH SIMULATION MODEL	7	2	2.5	4.8	1	2.5	3	36	39	40	95
3.6.7.3	ROTATING SUBASSEMBLY	7	2	10.0	19.0	1	10.0	3	36	39	40	95
3.6.7.4	HIGH VOLTAGE SUBASSEMBLY	7	2	7.4	14.0	1	7.4	3	36	39	40	95
3.6.7.5	FAN (MODEL COOLING)	7	2	0.1	0.2	1	0.1	3	36	39	40	95
3.6.7.6	OPTICAL COMPONENTS MOUNTING											
	SUBASSEMBLY	7	2	2.0	3.8	1	2.0	3	36	39	40	95
3.6.7.7	THERMAL CONTROLLERS	7	2	0.8	1.6	1	0.8	3	36	39	40	95
3.6.7.8	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	3.8	7.2	1	3.8	3	36	39	40	95
	TOTAL	6	2	53.2	101.1	1	53.2	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.6.8	NUCLEI CONDITIONING ASSEMBLY											
3.6.8.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	34.5	65.5	1	34.5	3	36	39	40	95
3.6.8.2	CHAMBER SUBASSEMBLY	7	2	16.1	30.5	1	16.1	3	36	39	40	95
3.6.8.3	AEROSOL CONDITIONING SUBASSEMBLY	7	2	5.4	10.3	1	5.4	3	36	39	40	95
3.6.8.4	ACOUSTICAL SUBASSEMBLY	7	2	3.5	6.6	1	3.5	3	36	39	40	95
3.6.8.5	NUCLEI PRECONDITIONER											
	SUBASSEMBLY	7	2	1.0	1.9	1	1.0	3	36	39	40	95
3.6.8.6	VALVES	7	2	4.5	8.5	1	4.5	3	36	39	40	95
3.6.8.7	THERMAL CONTROLLER	7	2	0.8	1.6	1	0.8	3	36	39	40	95
3.6.8.8	INSTRUMENTATION AND DISPLAY											
	SUBASSEMBLY	7	2	3.2	6.0	1	3.2	3	36	39	40	95
	TOTAL	6	2	69.0	130.9	1	69.0	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.7	CONSOLE											
3.7.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	30.6	58.2	1	30.6	3	33	39	40	95
3.7.2	CONSOLE SUPPORT STRUCTURE AND											
	SUBASSEMBLY	6	2	278.5	529.2	1	278.5	3	33	39	40	95
3.7.3	POWER CONTROL AND DISTRIBUTION	6	2	65.0	129.1	1	65.0	3	33	39	40	95
3.7.4	CONSOLE PANELS AND DRAWER											
	SUBASSEMBLY	6	2	36.3	69.0	1	36.3	3	33	39	40	95
3.7.5	OVERHEAD STORAGE SUBASSEMBLY	6	2	0	0	1	0	3	33	39	40	95
3.7.6	FLOOR SEGMENT SUBASSEMBLY	6	2	0	0	1	0	3	33	39	40	95
3.7.7	INSTRUMENTATION/DISPLAYS	6	2	3.2	6.4	1	3.2	3	33	39	40	95
	TOTAL	5	2	413.6	791.9	1	413.6	3	33	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.7.2	CONSOLE SUPPORT STRUCTURE AND											
	SUBASSEMBLY											
3.7.2.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	20.6	39.2	1	20.6	3	33	39	40	95
3.7.2.2	MOD. STNDRD. ERNO/.060M CAB.											
	STRUCT (SIDE CAB)	7	2	136.8	260.0	1	136.8	3	33	39	40	95
3.7.2.3	MOD STNDRD. ERNO .572M CAB.											
	STRUCT (SIDE CAB)	7	2	121.1	230.0	1	121.1	3	33	39	40	95
	TOTAL	6	2	278.5	529.2	1	278.5	3	33	39	40	95
3.7.3	POWER CONTROL AND DISTRIBUTION											
3.7.3.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	7	2	21.7	41.2	1	21.7	3	33	39	40	95
3.7.3.2	28 VDC RGULATED CIRCUITS	7	2	20.3	38.6	1	20.3	3	33	39	40	95
3.7.3.3	110 VAC 3 400 HZ CIRCUIT	7	2	0.8	1.6	1	0.8	3	33	39	40	95
3.7.3.4	110 VAC/400 HZ CIRCUIT	7	2	0.3	0.5	1	0.3	3	33	39	40	95
3.7.3.5	110 VAC/60 HZ CIRCUIT	7	2	16.6	31.5	1	16.6	3	33	39	40	95
3.7.3.6	INSTRUMENTATION	7	2	5.3	10.1	1	5.3	3	33	39	40	95
7	INITIAL SPARES	7	2		5.6	1		3	33	39	40	95
	TOTAL	6	2	65.0	129.1	1	65.0	3	33	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.8	OPTICAL DETECTION AND IMAGING											
	DEVICES											
3.8.1	INTEGRATION, ASSEMBLY, AND											
	CHECKOUT	6	2	23.1	43.8	1	23.1	3	36	39	40	95
3.8.2	CINE CAMERA	6	2	22.7	43.2	1	22.7	3	36	39	40	95
3.8.3	STILL CAMERA (35 mm)	6	2	11.6	22.0	1	11.6	3	36	39	40	95
3.8.4	MICROSCOPE TRINOCULAR	6	2	5.2	9.9	1	5.2	3	36	39	40	95
3.8.5	VIDEO CAMERA ASSEMBLY (16 mm)	6	2	11.0	20.9	1	11.0	3	36	39	40	95
3.8.6	LIGHT SOURCE	6	2	1.2	2.2	1	1.2	3	36	39	40	95
3.8.7	ANEMOMETER	6	2	75.7	143.9	1	75.7	3	36	39	40	95
3.8.8	STEREO MICROSCOPE	6	2	8.0	15.2	1	8.0	3	36	39	40	95
3.8.9	IR MICROSCOPE	6	2	142.9	271.6	1	142.9	3	36	39	40	95
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES	6	2	5.9	11.2	1	5.9	3	36	39	40	95
3.8.11	DISPLAYS	6	2	3.8	7.3	1	3.8	3	36	39	40	95
	INITIAL SPARES	6	2		26.9	1		3	36	39	40	95
	OPERATIONAL SPARES				-							
	TOTAL	5	2	311.1	618.1	1	311.1	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

PAGE 39 OF 45

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES											
3.8.10.1	COUPLING OPTICS	7	2	3.0	5.7	1	3.0	3	36	39	40	95
3.8.10.2	EXPOSURE METER	7	2	0.4	0.7	1	0.4	3	36	39	40	95
3.8.10.3	SPOOLS	7	2	0	0	1	0	3	36	39	40	95
3.8.10.4	FILM (35 mm)	7	2	0	0	1	0	3	36	39	40	95
3.8.10.5	VIEWPORTS	7	2	2.5	4.8	1	2.5	3	36	39	40	95
	TOTALS	6	2	5.9	11.2	1	5.9	3	36	39	40	95
3.8.11	DISPLAYS											
3.8.11.1	DIGITAL	7	2	0.6	1.2	1	0.6	3	36	39	40	95
3.8.11.2	ANALOG	7	2	0.9	1.8	1	0.9	3	36	39	40	95
3.8.11.3	INDICATOR LIGHTS	7	2	0.7	1.3	1	0.7	3	36	39	40	95
3.8.11.4	CONTROLS	7	2	1.6	3.0	1	1.6	3	36	39	40	95
	TOTAL	6	2	3.8	7.3	1	3.8	3	36	39	40	95

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
5.0	SYSTEM TEST											
5.1	SYSTEM TEST PLANNING											
5.2	MAJOR TEST ARTICLES											
5.3	SYSTEMS DEVELOPMENT TESTING											
5.4	SYSTEM VERIFICATION TESTING											
	TOTAL	4			0							

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
5.0	SYSTEM TEST											
5.1	SYSTEM TEST PLANNING											
5.2	MAJOR TEST ARTICLES											
5.3	SYSTEMS DEVELOPMENT TESTING											
5.4	SYSTEM VERIFICATION TESTING											
	TOTAL	4			0							

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
6.0	GROUND SUPPORT EQUIPMENT (GSE)											
6.1	GSE INTEGRATION	5			0							
6.2	ELECTRICAL/ELECTRONIC GSE	5			0							
6.3	MECHANICAL GSE	5			0							
6.4	TRANSPORTATION AND HANDLING GSE	5			0							
6.5	GSE SOFTWARE	5			0							
6.6	GSE MAINTENANCE	5			54.1				12	18	0	
	TOTAL	4			54.1				12	18	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
8.0	LOGISTICS											
8.1	TRAINING	5			0							
8.2	TRANSPORTATION AND HANDLING	5			5.0				6	9	0	
8.3	INVENTORY CONTROL	5			0							
	TOTAL	4			5.0				6	9	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/13/74

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
9.0	GROUND OPERATIONS											
9.1	RECOVERY OPERATIONS											
9.2	MAINTENANCE AND REFURBISHMENT											
	ACTIVITIES											
9.3	CHECKOUT OPERATIONS &											
	REFURBISHMENT FOR FLT											
9.4	LAUNCH OPERATIONS											
	TOTAL	4			0							

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A(2)

RECURRING (PRODUCTION)

DATE 9/13/74

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	1ST UNIT COST T_1	EXPECTED COST	REF UNIT	REFERENCE UNIT COST	CONFID RATING	T_d	T_s	SPREAD FUNC	LEARN INDEX
10.0	FLIGHT OPERATIONS											
10.1	MISSION PLANNING											
10.2	FLIGHT CONTROL AND EVALUATION											
	TOTAL	4			0							

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
1.0	PROJECT MANAGEMENT	4		449.2			3	132	6	0	
2.0	SYSTEM ENGINEERING AND INTEGRATION			633.6				132	6	0	
3.0	CLOUD PHYSICS EXPERIMENT LABORATORY			2,813.8				144	21	0	
4.0	EXPERIMENT SUPPORT HARDWARE			0				—	—	—	
5.0	SYSTEM TEST			0				—	—	—	
6.0	GROUND SUPPORT EQUIPMENT (GSE)			595.0				132	6	0	
7.0	FACILITIES			0				—	—	—	
8.0	LOGISTICS			160.9				132	6	0	
9.0	GROUND OPERATIONS			5,153.6				132	6	0	
10.0	FLIGHT OPERATIONS			122.3				126	0	0	
11.0	PRINCIPAL INVESTIGATOR OPERATIONS			6,803.5				132	6	0	
	TOTAL	3	42	16,731.9	1	398.4	3	144	6	0	100

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

COST DATA FORM — A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
2.0	SYSTEM ENGINEERING AND										
	INTEGRATION										
2.1	CPL/SPACELAB INTEGRATION	5		253.4			3	132	6	0	
2.2	CLOUD PHYSICS LABORATORY			190.0							
2.3	EXPERIMENT SUPPORT			63.4							
2.4	GROUND SUPPORT EQUIPMENT			63.4							
2.5	SAFETY, RELIABILITY & QUALITY			63.4							
	ASSURANCE										
	TOTAL	4		633.6			3	132	6	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_J	T_S	SPREAD FUNCT	LEARN INDEX
3.0	CLOUD PHYSICS EXPERIMENT LABORATORY										
3.1	FINAL ASSEMBLY, INTEGRATION, AND CHECKOUT	5		0			3	144	21	0	
3.2	THERMAL CONTROL/EXPENDABLES STOR. & CONT.			968.8							
3.3	PARTICLE GENERATORS			140.0							
3.4	DATA MANAGEMENT			352.4							
3.5	PARTICLE DETECTORS AND CHARACTERIZERS			303.6							
3.6	EXPERIMENT CHAMBERS			585.3							
3.7	CONSOLE			53.2							
3.8	OPTICAL DETECTION AND IMAGING DEVICES			410.5							
	TOTAL	4		2,813.8			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.2	THERMAL CONTROL/EXPENDABLES										
	STOR. & CONT.										
3.2.1	INTEGRATION, ASSEMBLY, AND										
	CHECKOUT										
3.2.2	THERMAL CONTROL										
3.2.3	FLOW, HUMIDITY, AND PRESSURE										
	CONTROL										
3.2.4	EXPENDABLES STORAGE										
3.2.5	INSTRUMENTATION AND DISPLAY										
	SUBASSEMBLY										
3.2.6	EXPENDABLES	6	42	630.0	1	15.0	3	144	21	0	100
3.2.7	CLEANSING, PURGE, AND VENT										
	SUBASSEMBLY										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	338.8	3	376.5	3	144	21	0	95
	TOTAL	5		968.8			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.3	PARTICLE GENERATORS										
3.3.1	INTEGRATION, ASSEMBLY, AND CHECKOUT										
3.3.2	WIRE PROBE RETRACTOR GENERATOR										
3.3.3	WATER DROP IMPELLER GENERATOR										
3.3.4	VIBRATING ORIFICE GENERATOR										
3.3.5	EVAPORATOR/CONDENSER GENERATOR										
3.3.6	SPRAY ATOMIZER GENERATOR										
3.3.7	POWDER DISPERSION GENERATOR										
3.3.8	PARTICLE INJECTOR & SIZE CONDITIONER										
3.3.9	INSTRUMENTATION/DISPLAYS										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	140.0	3	155.5	3	144	21	0	95
	TOTAL	5		140.0			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/16/74

PAGE 6 OF 16

COST DATA FORM — A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.4	DATA MANAGEMENT										
3.4.1	INTEGRATION, ASSEMBLY, AND CHECKOUT										
3.4.2	CONTROL PROCESSOR ASSEMBLY										
3.4.3	TAPE RECORDER ASSEMBLY										
3.4.4	MASTER CONTROL ASSEMBLY										
3.4.5	SIGNAL CONDITIONING ELECTRONICS ASSEMBLY										
3.4.6	INSTRUMENTATION AND DISPLAY ASSEMBLY										
3.4.7	EXPENDABLES	6	42	42.0	1	1.0	3	144	21	0	100
3.4.8	CABLE ASSEMBLIES										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	310.4	3	345.0	3	144	21	0	95
	TOTAL	5		352.4			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.5	PARTICLE DETECTORS AND										
	CHARACTERIZERS										
3.5.1	INTEGRATION, ASSEMBLY, AND										
	CHECKOUT										
3.5.2	OPTICAL PARTICLE COUNTER										
3.5.3	PULSE HEIGHT ANALYZER										
3.5.4	CONDENSATION NUCLEUS COUNTER										
3.5.5	MICROPOROUS FILTER										
3.5.6	QUARTZ CRYSTAL MASS MONITOR										
3.5.7	CASCADE IMPACTOR										
3.5.8	ELECTRICAL AEROSOL SIZE										
	ANALYZER										
3.5.9	SCATTEROMETER										
3.5.10	LIQUID WATER CONTENT METER										
3.5.11	DROPLET SIZE DISTRIBUTION METER										
3.5.12	OPTICAL THERMOELECTRIC DEW										
	POINT HYGROMETER										
3.5.13	ELECTRIC DEW POINT HYGROMETER										
3.5.14	INSTRUMENTATION/DISPLAYS										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	303.6	3	337.3	3	144	21	0	95
	TOTAL	5		303.6			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

DATE 9/16/74

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.6	EXPERIMENT CHAMBERS										
3.6.1	INTEGRATION, ASSEMBLY, AND										
	CHECKOUT										
3.6.2	STATIC DIFFUSION LIQUID CHAMBER										
	ASSEMBLY										
3.6.3	STATIC DIFFUSION ICE CHAMBER										
	ASSEMBLY										
3.6.4	GENERAL CHAMBER ASSEMBLY										
3.6.5	EXPANSION CHAMBER ASSEMBLY										
3.6.6	CONTINUOUS FLOW DIFFUSION										
	CHAMBER ASSEMBLY										
3.6.7	EARTH SIMULATION CHAMBER										
	ASSEMBLY										
3.6.8	NUCLEI CONDITIONING ASSEMBLY										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	585.3	3	650.3	3	144	21	0	95
	TOTAL	5		585.3			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.7	CONSOLE										
3.7.1	INTEGRATION, ASSEMBLY, AND CHECKOUT										
3.7.2	CONSOLE SUPPORT STRUCTURE AND SUBASSEMBLY										
3.7.3	POWER CONTROL AND DISTRIBUTION										
3.7.4	CONSOLE PANELS AND DRAWER SUBASSEMBLY										
3.7.5	OVERHEAD STORAGE SUBASSEMBLY										
3.7.6	FLOOR SEGMENT SUBASSEMBLY										
3.7.7	INSTRUMENTATION/DISPLAYS										
	OPERATIONAL SPARES	5	0.9	53.2	3	59.1	3	144	21	0	95
	TOTAL	5		53.2			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
3.8	OPTICAL DETECTION AND IMAGING DEVICES										
3.8.1	INTEGRATION, ASSEMBLY, AND CHECKOUT										
3.8.2	CINE CAMERA										
3.8.3	STILL CAMERA (35 mm)										
3.8.4	MICROSCOPE TRINOCULAR										
3.8.5	VIDEO CAMERA ASSEMBLY (16 mm)										
3.8.6	LIGHT SOURCE										
3.8.7	ANEMOMETER										
3.8.8	STEREO MICROSCOPE										
3.8.9	IR MICROSCOPE										
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES	6	42	168.0	1	4.0	3	144	21	0	100
3.8.11	DISPLAYS										
	INITIAL SPARES										
	OPERATIONAL SPARES	5	0.9	242.5	3	269.5	3	144	21	0	95
	TOTAL	5		410.5			3	144	21	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

DATE 9/16/74

PAGE 11 OF 16

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
5.0	SYSTEM TEST										
5.1	SYSTEM TEST PLANNING										
5.2	MAJOR TEST ARTICLES										
5.3	SYSTEMS DEVELOPMENT TESTING										
5.4	SYSTEM VERIFICATION TESTING										
	TOTAL	4		0							

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
6.0	GROUND SUPPORT EQUIPMENT (GSE)										
6.1	GSE INTEGRATION										
6.2	ELECTRICAL/ELECTRONIC GSE										
6.3	MECHANICAL GSE										
6.4	TRANSPORTATION AND HANDLING GSE										
6.5	GSE SOFTWARE										
6.6	GSE MAINTENANCE	5		595.0			3	132	6	0	
	TOTAL	4		595.0			3	132	6	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	NO OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
8.0	LOGISTICS										
8.1	TRAINING	5		105.6			3	132	6	0	
8.2	TRANSPORTATION AND HANDLING	5		2.5			3	132	6	0	
8.3	INVENTORY CONTROL	5		52.8			3	132	6	0	
	TOTAL	4		160.9			3	132	6	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
9.0	GROUND OPERATIONS										
9.1	RECOVERY OPERATIONS	5	42	855.5	1	20.37	3	132	6	0	100
9.2	MAINTENANCE AND REFURBISHMENT ACTIVITIES	5	42	1,241.9	1	29.57	3	132	6	0	100
9.3	CHECKOUT OPERATIONS & REFURBISHMENT FOR FLT	5	42	1,999.9	1	47.62	3	132	6	0	100
9.4	LAUNCH OPERATIONS	5	42	1,056.3	1	25.15	3	132	6	0	100
	TOTAL	4		5,153.6			3	132	6	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9/16/74

COST DATA FORM — A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
10.0	FLIGHT OPERATIONS										
10.1	MISSION PLANNING										
10.2	FLIGHT CONTROL AND EVALUATION	5	42	122.3	1	2.91	3	126	0	0	100
	TOTAL	4		122.3			3	126	0	0	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9/16/74

PAGE 16 OF 16

COST DATA FORM – A (3)

RECURRING (OPERATIONS)

IDENT NO	WBS IDENTIFICATION	WBS LEVEL	NO. OF UNITS	EXPECTED COST	REF UNIT	REF UNIT COST	CONF RATING	T_d	T_s	SPREAD FUNCT	LEARN INDEX
11.0	PRINCIPAL INVESTIGATOR (PI)										
	OPERATIONS										
11.1	PI PLANNING OPERATIONS	5	42	1,294.4	1	30.82	3	132	6	0	100
11.2	PI PREFLIGHT OPERATIONS	5	42	3,562.9	1	84.83	3	132	6	0	100
11.3	PI FLIGHT/POSTFLIGHT OPERATIONS	5	42	1,946.2	1	46.34	3	132	6	0	100
	TOTAL	4		6,803.5			3	132	6	0	

Technical Characteristics Data
(NASA Data Form B)

This subsection presents on Data Form-B the technical, physical and mission characteristics which have a significant effect on the cost of an item. As required, Data Form-B contains parameters that have been utilized in generating the cost estimates.

The data in Form-B complies with the following stipulation in Data Requirement Document MF-003M dated 7 May 1971: "Since the TCD is used for cost parameter purposes, it is not necessary that the sums of the lower level individual characteristics, such as weight or volume, equal the total weight or volume of the higher level WBS item."

In addition to, and/or in conjunction with, the parameters stated on Data Form-B, the following factors are reflected in the estimated costs:

- Technology
- Size/Shape/Materials/Weight
- Fabrication/Assembly Methods
- Tooling Requirements
- Quantities - Subsystems/Flight Articles
- Commonality
- Maintainability
- Test Philosophy
- Complexity/Workability

NOTE: Unless otherwise noted (*) Form "B" data are based on recurring (production) parameters.

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
	ZERO-GRAVITY ATMOSPHERIC CLOUD				
	PHYSICS EXPERIMENT LABORATORY	-	-	SUMMATION	
1.0	PROJECT MANAGEMENT	4.7	PER-CENT	(3.0 + 6.0 + 8.0)	
2.0	SYSTEM ENGR. AND INTEG.	NOTE:	-	DDT&E - %; PROD. - FACTOR; OPS. LEVEL OF	
				EFFORT	
3.0	CLOUD PHYSICS EXP. LAB	-	-	Σ SUBSYSTEMS	
3.1	FINAL ASSY. INTEG AND C/O	5	PER-CENT	Σ 3.2 - 3.8	
3.2	THERMAL CONTROL/EXPENDABLES				
	STORAGE AND CONT.	-	-	SUMMATION	
3.2.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.2.2	THERMAL CONTROL	-	-	Σ ASSEMBLY COSTS	
3.2.2.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.2.2.2	CLOUD CHAMBER COOLING				
	SUBASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.2.2.2.1	HYDRO-ELECTRICAL SWITCHING				
	MODULE	-	-	DIRECT ESTIMATE	
3.2.2.2.2	PUMP MODULE	-	-	Σ ASSEMBLY COSTS	
3.2.2.2.2.1	MOTOR	-	-	DIRECT ESTIMATE	
3.2.2.2.2.2	PUMP	-	-	-	INCLUDED IN 3.2.2.2.2.1
3.2.2.2.2.3	FILL/DRAIN Q.D.'S	-	-	DIRECT ESTIMATE	
3.2.2.2.2.4	ACCUMULATOR	-	-	-	INCLUDED in 3.2.2.2.2.1
3.2.2.2.2.5	FILTER	-	-	DIRECT ESTIMATE	
3.2.2.2.3	COOLANT DISTRIB. PLUMBING	10.8	POUNDS		

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.2.2.2.4	THERMAL CAP./CONTACT HX	-	-	DIRECT ESTIMATE	
3.2.2.3	SUPPORT EQUIP. COOLING SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.2.2.3.1	AIR DISTRIB. MANIFOLDS	8.6	POUNDS		
3.2.3	FLOW, HUMIDITY AND PRESS. CONT	-	-	Σ ASSEMBLY COSTS	
3.2.3.1	INTEG. ASSY. AND C/O	8	PER-CENT		
3.2.3.2	HUMIDIFICATION SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.2.3.2.1	WICK EVAPORATOR	1.8	POUNDS		
3.2.3.2.2	VALVE MODULE	67.9	POUNDS		
3.2.3.2.3	HUMIDIFICATION CHAMBER	-	-	Σ ASSEMBLY COSTS	
3.2.3.2.3.1	CHAMBER AND BELLOWS	-	-	DIRECT ESTIMATE	
3.2.3.2.3.2	BELLOWS POSITIONING MECH.	10.9	POUNDS		
3.2.3.3	WATER STORAGE AND SUPPLY				
	SUBASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.2.3.3.1	WATER TANK	-	-	DIRECT ESTIMATE	
3.2.3.3.2	VALVES	-	-	Σ COMPONENT COSTS	
3.2.3.3.2.1	SOLENOID	-	-	DIRECT ESTIMATE	
3.2.3.3.2.2	REGULATOR	-	-	DIRECT ESTIMATE	
3.2.3.3.3	WATER DISTRIB. PLUMBING	3.5	POUNDS		
3.2.4	EXPENDABLES STORAGE	-	-	Σ ASSEMBLY COSTS	
3.2.4.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.2.4.2	DRY AIR STORAGE SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.2.4.2.1	TANKS AND METEOROID SHIELDS	-	-	DIRECT ESTIMATE	
3.2.4.2.2	VALVES	-	-	Σ COMPONENT COSTS	

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.2.4.2.2.1	SOLENOID	-	-	DIRECT ESTIMATE	
3.2.4.2.2.2	RELIEF	-	-	DIRECT ESTIMATE	
3.2.4.2.2.3	CHECK	-	-	DIRECT ESTIMATE	
3.2.4.2.2.4	REGULATOR	-	-	DIRECT ESTIMATE	
3.2.4.2.3	FILL Q. D.	-	-	DIRECT ESTIMATE	
3.2.4.2.4	DISTRIB. AND VENT PLUMBING	8.6	POUNDS		
3.2.4.3	SAMPLE GAS STORAGE SUBASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.2.4.3.1	TANKS	-	-	DIRECT ESTIMATE	
3.2.4.3.2	RUPTURE DISC	-	-	DIRECT ESTIMATE	
3.2.4.3.3	DISTRIB. PLUMBING AND HOSES	19.2	POUNDS		
3.2.4.3.4	Q. D.'S	-	-	DIRECT ESTIMATE	
3.2.5	INSTR. AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.2.5.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.2.5.2	TEMPERATURE SENSORS	-	-	DIRECT ESTIMATE	
3.2.5.3	PRESSURE SENSORS	-	-	DIRECT ESTIMATE	
3.2.5.4	VISUAL DISPLAYS	-	-	-	INCLUDED IN CONSOLE
3.2.6	EXPENDABLES	-	-	DIRECT ESTIMATE	
3.2.7	CLEANSING PURGE AND VENT				
	SUBASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.2.7.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.2.7.2	VALVES	-	-	Σ COMPONENT COSTS	
3.2.7.2.1	SOLENOID	-	-	DIRECT ESTIMATE	
3.2.7.2.2	RELIEF	-	-	DIRECT ESTIMATE	

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.2.7.2.3	CHECK	-	-	DIRECT ESTIMATE	
3.2.7.2.4	REGULATOR	-	-	DIRECT ESTIMATE	
3.2.7.3	FILTER	-	-	Σ COMPONENT COSTS	
3.2.7.3.1	NO. 1	-	-	DIRECT ESTIMATE	
3.2.7.3.2	NO. 2	-	-	DIRECT ESTIMATE	
3.2.7.4	DISTRIB: PLUMBING	28.7	POUNDS		
3.3	PARTICLE GENERATORS	-	-	SUMMATION	
3.3.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.2	WIRE PROBE RETRACTOR GENERATOR	-	-	Σ ASSEMBLY COSTS	
3.3.2.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.2.2	DUAL PULSE GENERATOR	-	-	DIRECT ESTIMATE	
3.3.2.3	SWITCH	-	-	DIRECT ESTIMATE	
3.3.2.4	HIGH VOLT. PULSE GEN.	-	-	DIRECT ESTIMATE	
3.3.2.5	LINEAR ACTUATOR	-	-	DIRECT ESTIMATE	
3.3.2.6	WIRE PROBE RETRACTOR			DIRECT ESTIMATE	
3.3.2.7	VALVE	-	-	DIRECT ESTIMATE	
3.3.3	WATER DROP IMPELLER GENERATOR	-	-	Σ ASSEMBLY COSTS	
3.3.3.1	INTEG. ASSY. AND C/O	8	PER-CENT		
3.3.3.2	HIGH VOLT. PULSE GEN.	-	-	DIRECT ESTIMATE	
3.3.3.3	SWITCH	-	-	DIRECT ESTIMATE	
3.3.3.4	SOLENOID DRIVER	-	-	DIRECT ESTIMATE	
3.3.3.5	WATER DROP IMPELLER	-	-	DIRECT ESTIMATE	
3.3.3.6	VALVE	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

PAGE 5 OF 32

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.3.4	VIBRATING ORIFICE GEN.	-	-	Σ ASSEMBLY COSTS	
3.3.4.1	INTEG. ASSY. AND C/O	8	PER-CENT		
3.3.4.2	FREQ. GENERATOR	-	-	DIRECT ESTIMATE	
3.3.4.3	POSITIVE DISPLACEMENT PUMP	-	-	DIRECT ESTIMATE	
3.3.4.4	VIBRATING ORIFICE	-	-	DIRECT ESTIMATE	
3.3.4.5	VALVE	-	-	DIRECT ESTIMATE	
3.3.4.6	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.5	EVAPORATOR/CONDENSER				
	GENERATOR	-	-	Σ ASSEMBLY COSTS	
3.3.5.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.5.2	EVAPORATOR FURNACE	-	-	DIRECT ESTIMATE	
3.3.5.3	CONDENSER	-	-	DIRECT ESTIMATE	
3.3.5.4	THERMAL CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.5.5	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.5.6	VALVE	-	-	DIRECT ESTIMATE	
3.3.6	SPRAY ATOMIZER GEN	-	-	Σ ASSEMBLY COSTS	
3.3.6.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.6.2	POSITIVE DISPLACEMENT PUMP	-	-	DIRECT ESTIMATE	
3.3.6.3	SPRAY ATOMIZER	-	-	DIRECT ESTIMATE	
3.3.6.4	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.6.5	VALVE	-	-	DIRECT ESTIMATE	
3.3.7	POWER DISPERSION GEN	-	-	Σ ASSEMBLY COSTS	
3.3.7.1	INTEG. ASSY AND C/O	8	PER-CENT		

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.3.7.2	POWER DISPERSER	-	-	DIRECT ESTIMATE	
3.3.7.3	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.7.4	VALVE	-	-	DIRECT ESTIMATE	
3.3.8	PARTICLE INJECTOR AND SIZE				
	CONDITIONER	-	-	SUMMATION	
3.3.8.1	INTEG. ASSY AND C/O	100	PER-CENT		
3.3.8.2	CONDITIONER WALL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.3.8.2.1	HEAT PIPE	-	-	DIRECT ESTIMATE	
3.3.8.2.2	THERMOELECT. MODULES	-	-	DIRECT ESTIMATE	
3.3.8.2.3	INSULATION	-	-	DIRECT ESTIMATE	
3.3.8.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.3.8.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.3.8.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.3.8.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.3.8.4	EQUIP. MOUNTING PORTS	-	-	DIRECT ESTIMATE	
3.3.8.5	WATER WICKING SURFACE	-	-	DIRECT ESTIMATE	
3.3.8.6	ACOUSTICAL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.3.8.6.1	ACOUSTICAL TRANSDUCERS	-	-	DIRECT ESTIMATE	
3.3.8.6.2	MICROPHONE PICKUP AMP.	-	-	DIRECT ESTIMATE	
3.3.8.6.3	PHASE LOCK LOOP CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.8.6.4	POWER	-	-	-	INCLUDED IN 3.3.8.6.3
3.3.8.7	THERMAL CONTROLLER	-	-	DIRECT ESTIMATE	
3.3.8.8	VELOCITY CONTROLLER	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.3.8.9	SHUTTER VALVE	-	-	DIRECT ESTIMATE	
3.3.8.10	VALVES	-	-	DIRECT ESTIMATE	
3.3.8.11	INSTR. AND DISPLAY	-	-	Σ ASSEMBLY COSTS	
3.3.8.11.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.8.11.2	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.3.8.11.3	PRESS. SENSORS	-	-	DIRECT ESTIMATE	
3.3.8.11.4	DIGITAL DISPLAYS	-	-	DIRECT ESTIMATE	
3.3.9	INSTR. DISPLAYS	-	-	Σ ASSEMBLY COSTS	
3.3.9.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.3.9.2	VOLTAGE SENSORS	-	-	DIRECT ESTIMATE	
3.3.9.3	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.3.9.4	AIRFLOW SENSORS	-	-	DIRECT ESTIMATE	
3.3.9.5	POSITION SENSORS	-	-	DIRECT ESTIMATE	
3.3.9.6	FREQ. SENSORS	-	-	DIRECT ESTIMATE	
3.3.9.7	DISPLAYS	-	-	Σ ASSEMBLY COSTS	
3.3.9.7.1	DIGITAL	-	-	DIRECT ESTIMATE	
3.3.9.7.2	ANALOG	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.4	DATA MANAGEMENT			SUMMATION	
3.4.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.4.2	CONTROL PROCESSOR ASSY	-	-	Σ ASSEMBLY COSTS	
3.4.2.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.4.2.2	CONTROL PROCESSOR	-	-	Σ ASSEMBLY COSTS	
3.4.2.2.1	I/O AND INTERFACE ADAPTER	22	POUNDS		
3.4.2.2.2	PROCESSOR	-	-	DIRECT ESTIMATE	
3.4.2.3	SOFTWARE	-	-	Σ 3.4.2.3.1 - 3.4.2.3.4	
3.4.2.3.1	VERIFICATION AND VALIDATION	-	-	DIRECT ESTIMATE	
3.4.2.3.2	OPERATIONAL	-	-	DIRECT ESTIMATE	
3.4.2.3.3	SUPPORT	-	-	DIRECT ESTIMATE	
3.4.2.3.4	MAINTENANCE	-	-	DIRECT ESTIMATE	
3.4.2.4	CONTROL UNITS	15.4	POUNDS		
3.4.2.4.1	INTERFACE ELECTRONICS	-	-	-	INCLUDED IN 3.4.2.4
3.4.2.4.2	CONTROL AND OUTPUT ELECTRONICS	-	-	-	INCLUDED IN 3.4.2.4
3.4.3	TAPE RECORDER ASSY	-	-	FURNISHED BY SPACELAB OR G.F.E.	
3.4.4	MASTER CONTROL ASSY	-	-	Σ ASSEMBLY COSTS	
3.4.4.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.4.4.2	KEYBOARD	-	-	DIRECT ESTIMATE	
3.4.4.2.1	TELETYPE SECTION	-	-	-	INCLUDED IN 3.4.4.2
3.4.4.2.2	FUNCTION KEY SECTION	-	-	-	INCLUDED IN 3.4.4.2

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.4.4.3	DISCRETE CONTROLS	33	POUNDS		
3.4.4.3.1	SYSTEM SWITCHING	-	-	-	INCLUDED IN 3.4.4.3
3.4.4.3.2	SYSTEM ADJUSTMENT	-	-	-	INCLUDED IN 3.4.4.3
3.4.5	SIG COND. ELECT. ASSY	-	-	Σ ASSEMBLY COSTS	
3.4.5.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.4.5.2	ANALOG COND. ELECT.	11	POUNDS		
3.4.5.3	DIGITAL COND. ELECT.	11	POUNDS		
3.4.5.4	FORMATTER	-	-	DIRECT ESTIMATE	
3.4.5.4.1	MULTIPLEXER	-	-	-	INCLUDED IN 3.4.5.4
3.4.5.4.2	A/D CONVERTER	-	-	-	INCLUDED IN 3.4.5.4
3.4.5.4.3	CONTROL AND TIMING	-	-	-	INCLUDED IN 3.4.5.4
3.4.5.5	RPU	-	-	FURNISHED BY SPACELAB OR G.F.E.	
3.4.5.6	INTERCOM	-	-	Σ COMPONENT COSTS	
3.4.5.6.1	INTERCOM UNIT	-	-	DIRECT ESTIMATE	
3.4.5.6.2	MICROPHONE AND HEADSET	-	-	DIRECT ESTIMATE	
3.4.5.7	CAUTION/WARNING ELECT.	-	-	FURNISHED BY SPACELAB OR G.F.E.	
3.4.6	INSTR. AND DISPLAY ASSY	-	-	Σ ASSEMBLY COSTS	
3.4.6.1	INTEG ASSY AND C/O	8	PER-CENT		
3.4.6.2	INSTRUMENTATION	-	-	Σ ASSEMBLY COSTS	
3.4.6.2.1	ANALOG TRANSDUCERS	-	-	DIRECT ESTIMATE	
3.4.6.2.2	DIGITAL CIRCUITS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.4.6.3	VIDEO MONITOR	-	-	DIRECT ESTIMATE	
3.4.6.3.1	CRT MONITOR	-	-	-	INCLUDED IN 3.4.6.3
3.4.6.3.2	CRT CONTROL UNIT	-	-	-	INCLUDED IN 3.4.6.3
3.4.6.4	GRAPHICS DISPLAY UNIT	-	-	DIRECT ESTIMATE	
3.4.6.4.1	CRT CHASSIS AND DEFLECTION				
	CIRCUIT	-	-	-	INCLUDED IN 3.4.6.4
3.4.6.4.2	CRT CONTROL UNIT	-	-	-	INCLUDED IN 3.4.6.4
3.4.6.4.3	DISPLAY GENERATOR AND COMPUTER				
	I/O	-	-	-	INCLUDED IN 3.4.6.4
3.4.6.4.4	COMM. INTERFACE	-	-	-	INCLUDED IN 3.4.6.4
3.4.6.5	SEQUENCE DISPLAY UNIT	26.5	POUNDS		
3.4.6.5.1	PANEL DISPLAY	-	-	-	INCLUDED IN 3.4.6.5
3.4.6.5.2	CONT. AND DRIVE ELECTRONICS	-	-	-	INCLUDED IN 3.4.6.5
3.4.6.6	TIME DISPLAY	-	-	Σ COMPONENT COSTS	
3.4.6.6.1	GMT, MET DISPLAY AND DRIVE UNIT	-	-	DIRECT ESTIMATE	
3.4.6.6.2	EVENT TIMERS	-	-	DIRECT ESTIMATE	
3.4.7	EXPENDABLES	-	-	-	NOT APPLICABLE
3.4.8	CABLE ASSYS	9.2	POUNDS		
3.5	PARTICLE DETECTORS AND				
	CHARACTERIZERS	-	-	SUMMATION	
3.5.1	INTEG. ASSY AND C/O	8	PERCENT		
3.5.2	OPTICAL PARTICLE COUNTER	-	-	Σ ASSEMBLY COSTS	
3.5.2.1	INTEG. ASSY AND C/O	8	PERCENT		

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.5.2.2	SENSOR	-	-	DIRECT ESTIMATE	
3.5.2.3	PARTICLE COUNTER	-	-	DIRECT ESTIMATE	
3.5.2.4	VACUUM PUMP	-	-	-	INCLUDED IN 3.5.2.3
3.5.2.5	VALVE	-	-	DIRECT ESTIMATE	
3.5.2.6	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.3	PULSE HEIGHT ANALYZER	-	-	Σ ASSEMBLY COSTS	
3.5.3.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.3.2	ANALYZER WITH READOUT	-	-	DIRECT ESTIMATE	
3.5.3.3	OSCILLOSCOPE	-	-	DIRECT ESTIMATE	
3.5.4	CONDENSATION NUCLEUS COUNTER	-	-	Σ ASSEMBLY COSTS	
3.5.4.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.4.2	COUNTER CONTROL	-	-	DIRECT ESTIMATE	
3.5.4.3	VALVE	-	-	DIRECT ESTIMATE	
3.5.4.4	POSITIVE DISPLACEMENT PUMP	-	-	DIRECT ESTIMATE	
3.5.4.5	VACUUM PUMP	-	-	DIRECT ESTIMATE	
3.5.4.6	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.5	MICROPOROUS FILTER	-	-	Σ ASSEMBLY COSTS	
3.5.5.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.5.2	FILTER HOUSING	-	-	DIRECT ESTIMATE	
3.5.5.3	VACUUM PUMP	-	-	DIRECT ESTIMATE	
3.5.5.4	FILTER STORAGE CONTAINER	5	POUNDS		
3.5.5.5	NUCLEI SAMPLE FILTERS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.5.5.6	VALVE	-	-	DIRECT ESTIMATE	
3.5.5.7	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.5.8	TIMER/CLOCK CONTROL	-	-	DIRECT ESTIMATE	
3.5.6	QUARTZ CRYSTAL MASS MONITOR	-	-	Σ ASSEMBLY COSTS	
3.5.6.1	INTEG ASSY AND C/O	8	PER-CENT		
3.5.6.2	PARTICLE MASS MONITOR	-	-	DIRECT ESTIMATE	
3.5.6.3	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.6.4	VALVE	-	-	DIRECT ESTIMATE	
3.5.6.5	VACUUM PUMP	-	-	DIRECT ESTIMATE	
3.5.7	CASCADE IMPACTOR	-	-	Σ ASSEMBLY COSTS	
3.5.7.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.7.2	CASCADE IMPACTOR HOUSING	-	-	DIRECT ESTIMATE	
3.5.7.3	VACUUM PUMP	-	-	DIRECT ESTIMATE	
3.5.7.4	SLIDE STORAGE CONTAINER	5	POUNDS		
3.5.7.5	SLIDES	-	-	DIRECT ESTIMATE	
3.5.7.6	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.7.7	VALVE	-	-	DIRECT ESTIMATE	
3.5.7.8	TIMER/CLOCK CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.8	ELECTRICAL AEROSOL SIZE				
	ANALYZER	-	-	Σ ASSEMBLY COSTS	
3.5.8.1	INTEG ASSY AND C/O	8	PER-CENT		
3.5.8.2	FLOW MODULE	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.5.8.3	CONTROL CIRCUIT/READOUT	-	-	-	INCLUDED IN 3.5.8.2
3.5.8.4	VACUUM PUMP	-	-	DIRECT ESTIMATE	
3.5.8.5	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.8.6	VALVE	-	-	DIRECT ESTIMATE	
3.5.9	SCATTEROMETER	-	-	Σ ASSEMBLY COSTS	
3.5.9.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.9.2	PHOTO DETECTOR	-	-	DIRECT ESTIMATE	
3.5.9.3	INDEXING MOUNT	-	-	DIRECT ESTIMATE	
3.5.9.4	LASER LIGHT SOURCE	-	-	DIRECT ESTIMATE	
3.5.9.5	ELECTRONICS AND CONTROLS	-	-	DIRECT ESTIMATE	
3.5.10	LIQUID WATER CONTENT METER	-	-	Σ ASSEMBLY COSTS	
3.5.10.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.10.2	PHOTO DETECTOR	-	-	DIRECT ESTIMATE	
3.5.10.3	LASER LIGHT SOURCE	-	-	DIRECT ESTIMATE	
3.5.10.4	ELECTRONICS AND CONTROLS	-	-	DIRECT ESTIMATE	
3.5.11	DROPLET SIZE DISTRIBUTION METER	-	-	Σ ASSEMBLY COSTS	
3.5.11.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.11.2	PHOTO DETECTOR	-	-	DIRECT ESTIMATE	
3.5.11.3	LASER LIGHT SOURCE	-	-	DIRECT ESTIMATE	
3.5.11.4	ELECTRONICS AND CONTROLS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.5.12	OPTICAL THERMOELECTRIC DEW				
	POINT HYGROMETER	-	-	Σ ASSEMBLY COSTS	
3.5.12.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.12.2	SENSOR	-	-	DIRECT ESTIMATE	
3.5.12.3	SENSING UNIT	-	-	-	INCLUDED IN 3.5.12.2
3.5.12.4	READOUT	-	-	-	INCLUDED IN 3.5.12.2
3.5.12.5	VALVE	-	-	DIRECT ESTIMATE	
3.5.12.6	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.5.13	ELECT. DEW POINT HYGROMETER	-	-	Σ ASSEMBLY COSTS	
3.5.13.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.13.2	DEW POINT HYGROMETER	-	-	DIRECT ESTIMATE	
3.5.13.3	SENSOR	-	-	DIRECT ESTIMATE	
3.5.14	INSTR/DISPLAYS	-	-	Σ ASSEMBLY COSTS	
3.5.14.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.5.14.2	VOLTAGE SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.3	CURRENT SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.4	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.5	AIR FLOW SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.6	PRESS SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.7	FREQ. SENSORS	-	-	DIRECT ESTIMATE	
3.5.14.8	DISPLAYS	-	-	Σ ASSEMBLY COSTS	
3.5.14.8.1	DIGITAL	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.5.14.8.2	ANALOG	-	-	DIRECT ESTIMATE	
3.6	EXPERIMENT CHAMBERS AND AERO-				
	SOL CONDITIONING ASSY	-	-	SUMMATION	
3.6.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.6.2	STATIC DIFFUSION LIQUID CHAMBER				
	ASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.6.2.1	INTEG. ASSY AND C/O	100	PER-CENT		
3.6.2.2	CHAMBER WALL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.2.2.1	HEAT PIPES	-	-	DIRECT ESTIMATE	
3.6.2.2.2	THERMOELECT. MODULES	-	-	DIRECT ESTIMATE	
3.6.2.2.3	INSULATION	10^4	cm^3		
3.6.2.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.6.2.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.6.2.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.6.2.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.6.2.4	EQUIP. MOUNTING PORTS	-	-	DIRECT ESTIMATE	
3.6.2.5	WATER WICKING SURFACES	-	-	DIRECT ESTIMATE	
3.6.2.6	LIGHT TRAP	-	-	DIRECT ESTIMATE	
3.6.2.7	THERMAL CONTROLLERS	-	-	DIRECT ESTIMATE	
3.6.2.8	INSTR. AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.2.8.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.6.2.8.2	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.6.2.8.3	PRESS. SENSORS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.2.8.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.3	STATIC DIFFUSION ICE CHAMBER				
	ASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.6.3.1	INTEG ASSY AND C/O	100	PER-CENT		
3.6.3.2	CHAMBER WALL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.3.2.1	HEAT PIPE	-	-	DIRECT ESTIMATE	
3.6.3.2.2	THERMOELECT MODULES	-	-	DIRECT ESTIMATE	
3.6.3.2.3	INSULATION	-	-	DIRECT ESTIMATE	
3.6.3.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.6.3.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.6.3.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.6.3.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.6.3.4	EQUIP MOUNTING PORTS	-	-	DIRECT ESTIMATE	
3.6.3.5	WATER WICKING SURFACES	-	-	DIRECT ESTIMATE	
3.6.3.6	ELECT FIELD SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.3.6.1	FIELD PLATES	-	-	DIRECT ESTIMATE	
3.6.3.6.2	AC FIELD CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.3.6.3	DC FIELD CONTROLLER	-	-	-	INCLUDED IN 3.6.3.6.2
3.6.3.6.4	POWER CONVERTER	-	-	DIRECT ESTIMATE	
3.6.3.7	OPTICAL CONDITIONING SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.3.7.1	LIGHT SOURCE (IR)	-	-	DIRECT ESTIMATE	
3.6.3.7.2	FOCUS OPTICS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.3.7.3	MOUNT/HOUSING	-	-	DIRECT ESTIMATE	
3.6.3.7.4	FAN	-	-	-	INCLUDED IN 3.6.3.7.3
3.6.3.8	ACOUSTICAL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.3.8.1	ACOUSTICAL XDUCERS	-	-	DIRECT ESTIMATE	
3.6.3.8.2	MICROPHONE PICKUP/AMP	-	-	DIRECT ESTIMATE	
3.6.3.8.3	PHASE LOCK LOOP CONT	-	-	DIRECT ESTIMATE	
3.6.3.8.4	POWER AMPLIFIER	-	-	-	INCLUDED IN 3.6.3.8.3
3.6.3.9	SCATTEROMETER INTERFACE EQUIP	-	-	DIRECT ESTIMATE	
3.6.3.10	LIGHT TRAPS	-	-	DIRECT ESTIMATE	
3.6.3.11	THERMAL CONTROLLERS	-	-	DIRECT ESTIMATE	
3.6.3.12	INSTR AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.3.12.1	INTEG ASSY AND C/O	8	PER-CENT		
3.6.3.12.2	TEMP SENSORS	-	-	DIRECT ESTIMATE	
3.6.3.12.3	PRESS SENSORS	-	-	DIRECT ESTIMATE	
3.6.3.12.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.4	GENERAL CHAMBER ASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.1	INTEG ASSY AND C/O	100	PER-CENT		
3.6.4.2	CHAMBER WALL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.2.1	HEAT PIPE	-	-	DIRECT ESTIMATE	
3.6.4.2.2	THERMOELECT MODULES	-	-	DIRECT ESTIMATE	
3.6.4.2.3	INSULATION	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.4.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.6.4.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.6.4.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.6.4.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.6.4.4	EQUIP MOUNTING PORTS	-	-	DIRECT ESTIMATE	
3.6.4.5	ELECT FIELD SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.5.1	FIELD PLATES	-	-	DIRECT ESTIMATE	
3.6.4.5.2	AC FIELD CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.4.5.3	DC FIELD CONTROLLER	-	-	-	INCLUDED IN 3.6.4.5.2
3.6.4.5.4	POWER CONVERTER	-	-	DIRECT ESTIMATE	
3.6.4.6	OPTICAL CONDITIONING SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.6.1	LIGHT SOURCE (IR)	-	-	DIRECT ESTIMATE	
3.6.4.6.2	FOCUS OPTICS	-	-	DIRECT ESTIMATE	
3.6.4.6.3	MOUNT/HOUSING	-	-	DIRECT ESTIMATE	
3.6.4.6.4	FAN	-	-	-	INCLUDED IN 3.6.4.6.3
3.6.4.7	ACOUSTICAL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.7.1	ACOUSTICAL XDUCERS	-	-	DIRECT ESTIMATE	
3.6.4.7.2	MICROPHONE PICKUP/AMP	-	-	DIRECT ESTIMATE	
3.6.4.7.3	PHASE LOCK LOOP CONT	-	-	DIRECT ESTIMATE	
3.6.4.7.4	POWER AMPLIFIER	-	-	-	INCLUDED IN 3.6.4.7.3
3.6.4.8	LIGHT TRAPS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.4.9	SCATTEROMETER INTERFACE EQUIP	-	-	DIRECT ESTIMATE	
3.6.4.10	THERMAL CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.4.11	INSTR AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.4.11.1	INTEG ASSY AND C/O	8	PER-CENT		
3.6.4.11.2	TEMP SENSORS	-	-	DIRECT ESTIMATE	
3.6.4.11.3	PRESS SENSORS	-	-	DIRECT ESTIMATE	
3.6.4.11.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.5	EXPANSION CHAMBER ASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.1	INTEG ASSY AND C/O	100	PER-CENT		
3.6.5.2	CHAMBER WALL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.2.1	HEAT PIPE	-	-	DIRECT ESTIMATE	
3.6.5.2.2	THERMOELECT MODULES	-	-	DIRECT ESTIMATE	
3.6.5.2.3	INSULATION	-	-	DIRECT ESTIMATE	
3.6.5.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.6.5.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.6.5.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.6.5.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.6.5.4	EQUIP MOUNTING PORTS	-	-	DIRECT ESTIMATE	
3.6.5.5	ELECT FIELD SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.5.1	FIELD PLATES	-	-	DIRECT ESTIMATE	
3.6.5.5.2	AC FIELD CONTROLLER	-	-	DIRECT ESTIMATE	

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.5.5.3	DC FIELD CONTROLLER	-	-	-	INCLUDED IN 3.6.5.5.2
3.6.5.5.4	POWER CONVERTER	-	-	DIRECT ESTIMATE	
3.6.5.6	OPTICAL HEATING SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.6.1	LIGHT SOURCE	-	-	DIRECT ESTIMATE	
3.6.5.6.2	FOCUS OPTICS	-	-	DIRECT ESTIMATE	
3.6.5.6.3	MOUNT/HOUSING	-	-	DIRECT ESTIMATE	
3.6.5.6.4	FAN	-	-	-	INCLUDED IN 3.6.5.6.3
3.6.5.7	ACOUSTICAL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.7.1	ACOUSTICAL XDUCERS	-	-	DIRECT ESTIMATE	
3.6.5.7.2	MICROWAVE PICKUP/AMP	-	-	DIRECT ESTIMATE	
3.6.5.7.3	PHASE LOCK LOOP CONT	-	-	DIRECT ESTIMATE	
3.6.5.7.4	POWER AMPLIFIER	-	-	-	INCLUDED IN 3.6.5.7.3
3.6.5.8	EXPANSION CONT SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.8.1	CHAMBER AND BELLOWS	-	-	DIRECT ESTIMATE	
3.6.5.8.2	BELLOWS POSITIONING MECH	-	-	DIRECT ESTIMATE	
3.6.5.9	LIGHT TRAPS	-	-	DIRECT ESTIMATE	
3.6.5.10	SCATTEROMETER INTERFACE EQUIP	-	-	DIRECT ESTIMATE	
3.6.5.11	THERMAL CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.5.12	INSTR AND DISPLAYS SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.5.12.1	INTEG ASSY AND C/O	8	PER-CENT		
3.6.5.12.2	TEMP SENSORS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

DATE 9-9-74

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.5.12.3	PRESS SENSORS	-	-	DIRECT ESTIMATE	
3.6.5.12.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.6	CONTINUOUS FLOW DIFFUSION				
	CHAMBER ASSY	-	-	Σ ASSEMBLY COSTS	
3.6.6.1	INTEG ASSY AND C/O	100	PER-CENT		
3.6.6.2	CHAMBER PLATE SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.6.2.1	HEAT PIPE	-	-	DIRECT ESTIMATE	
3.6.6.2.2	THERMOELECT MODULES	-	-	DIRECT ESTIMATE	
3.6.6.2.3	INSULATION	-	-	DIRECT ESTIMATE	
3.6.6.2.4	HEAT EXCHANGER/MANIFOLD	-	-	DIRECT ESTIMATE	
3.6.6.2.5	OUTER WALL	-	-	DIRECT ESTIMATE	
3.6.6.2.6	SIDE WALL	-	-	DIRECT ESTIMATE	
3.6.6.3	OPTICAL PORTS	-	-	DIRECT ESTIMATE	
3.6.6.4	WATER WICKING SURFACES	-	-	DIRECT ESTIMATE	
3.6.6.5	CHAMBER WALL SUBASSY	-	-	-	INCLUDED IN 3.6.6.2
3.6.6.6	CARRIER AIR SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.6.6.1	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.6.6.2	AIR FILTER	-	-	DIRECT ESTIMATE	
3.6.6.7	SHEATH AIR SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.6.7.1	FLOW CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.6.7.2	HEAT EXCHANGER	-	-	DIRECT ESTIMATE	
3.6.6.8	THERMAL CONTROLLERS	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.6.9	INSTR. AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.6.9.1	INTEG., ASSY AND C/O	8	PER-CENT		
3.6.6.9.2	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.6.6.9.3	PRESS. SENSORS	-	-	DIRECT ESTIMATE	
3.6.6.9.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.6.9.5	FLOW SENSORS	-	-	DIRECT ESTIMATE	
3.6.7	EARTH SIMULATION CHAMBER ASSY	-	-	Σ ASSEMBLY COSTS	
3.6.7.1	INTEG., ASSY AND C/O	100	PER-CENT		
3.6.7.2	EARTH SIMULATION MODEL	-	-	DIRECT ESTIMATE	
3.6.7.2.1	OUTER SPHERE	-	-	-	INCLUDED IN 3.6.7.2
3.6.7.2.2	INNER SPHERE	-	-	-	INCLUDED IN 3.6.7.2
3.6.7.2.3	DIELECTRIC FLUID	-	-	-	INCLUDED IN 3.6.7.2
3.6.7.2.4	HEATER ELEMENT	-	-	-	INCLUDED IN 3.6.7.2
3.6.7.3	ROTATING SUBASSY	-	-	DIRECT ESTIMATE	
3.6.7.3.1	BASE PLATE	-	-	-	INCLUDED IN 3.6.7.3
3.6.7.3.2	BEARING AND MOUNT	-	-	-	INCLUDED IN 3.6.7.3
3.6.7.3.3	CYLINDRICAL HOUSING	-	-	-	INCLUDED IN 3.6.7.3
3.6.7.3.4	MOTOR AND MECH. COUPLING	-	-	-	INCLUDED IN 3.6.7.3
3.6.7.4	HIGH VOLTAGE SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.7.4.1	POWER CONVERTER	-	-	DIRECT ESTIMATE	
3.6.7.4.2	CONTROLLER	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.7.5	FAN (MODEL COOLING)	-	-	DIRECT ESTIMATE	
3.6.7.6	OPTICAL COMPONENTS MOUNTING				
	SUBASSY	-	-	DIRECT ESTIMATE	
3.6.7.6.1	HEMISPHERE MOUNTING SURFACE/				
	RING	-	-	-	INCLUDED IN 3.6.7.6
3.6.7.6.2	LIGHT SOURCE MOUNT	-	-	-	INCLUDED IN 3.6.7.6
3.6.7.6.3	CAMERA MOUNT	-	-	-	INCLUDED IN 3.6.7.6
3.6.7.6.4	INDEX TABLE	-	-	-	INCLUDED IN 3.6.7.6
3.6.7.6.5	POSITION SENSOR	-	-	-	INCLUDED IN 3.6.7.6
3.6.7.7	THERMAL CONTROLLERS	-	-	DIRECT ESTIMATE	
3.6.7.8	INSTR. AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.7.8.1	INTEG., ASSY AND C/O	8	PER-CENT		
3.6.7.8.2	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.6.7.8.3	PRESS. SENSORS	-	-	DIRECT ESTIMATE	
3.6.7.8.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.6.8	NUCLEI CONDITIONING ASSY	-	-	Σ ASSEMBLY COSTS	
3.6.8.1	INTEG. ASSY AND C/O	100	PER-CENT		
3.6.8.2	CHAMBER SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.8.2.1	CHAMBER AND BELLOWS	-	-	DIRECT ESTIMATE	
3.6.8.2.2	BELLOWS POSITIONING MECH.	-	-	DIRECT ESTIMATE	
3.6.8.2.3	HEATER	-	-	DIRECT ESTIMATE	
3.6.8.2.4	INSULATION	-	-	DIRECT ESTIMATE	
3.6.8.3	AEROSOL CONDITIONING SUBASSY	-	-	Σ ASSEMBLY COSTS	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.6.8.3.1	LIGHT SOURCE - UV	-	-	DIRECT ESTIMATE	
3.6.8.3.2	DIFFUSION/FILTER OPTICS	-	-	DIRECT ESTIMATE	
3.6.8.3.3	MOUNT/HOUSING	-	-	DIRECT ESTIMATE	
3.6.8.3.4	MIXING FAN	-	-	-	INCLUDED IN 3.6.8.3.3
3.6.8.4	ACOUSTICAL SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.8.4.1	ACOUSTICAL XDUXER	-	-	DIRECT ESTIMATE	
3.6.8.4.2	POWER AMPLIFIER	-	-	DIRECT ESTIMATE	
3.6.8.4.3	ACOUSTICAL DETECTOR	-	-	DIRECT ESTIMATE	
3.6.8.5	NUCLEI PRECONDITIONER SUBASSY	-	-	DIRECT ESTIMATE	
3.6.8.5.1	COAGULATION TUBE	-	-	-	INCLUDED IN 3.6.8.5
3.6.8.5.2	DIFFUSION BATTERY	-	-	-	INCLUDED IN 3.6.8.5
3.6.8.6	VALVES	-	-	DIRECT ESTIMATE	
3.6.8.7	THERMAL CONTROLLER	-	-	DIRECT ESTIMATE	
3.6.8.8	INSTR. AND DISPLAY SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.6.8.8.1	INTEG., ASSY AND C/O	8	PER-CENT		
3.6.8.8.2	TEMP. SENSORS	-	-	DIRECT ESTIMATE	
3.6.8.8.3	PRESS. SENSORS	-	-	DIRECT ESTIMATE	
3.6.8.8.4	VISUAL DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	
3.7	CONSOLE	-	-	SUMMATION	
3.7.1	INTEG., ASSY AND C/O	8	PER-CENT		

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.7.2	CONSOLE SUPPORT STRUCTURE AND				
	SUBASSY	-	-	Σ ASSEMBLY COSTS	
3.7.2.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.7.2.2	MODIFIED STANDARD ERNO 1.060 M				
	CABINET STRUCTURE	-	-	DIRECT ESTIMATE	
3.7.2.3	MODIFIED STANDARD ERNO .572 M				
	CABINET STRUCTURE	-	-	DIRECT ESTIMATE	
3.7.4	CONSOLE PANELS AND DRAWER				
	SUBASSY	211	POUNDS		
3.7.5	OVERHEAD STORAGE SUBASSY	-	-	PROVIDED BY SPACELAB	
3.7.6	FLOOR SEGMENT SUBASSY	-	-	PROVIDED BY SPACELAB	
3.7.7	INSTR. AND DISPLAYS	-	-	Σ ASSEMBLY COSTS	
3.7.7.1	INTEG. ASSY AND C/O	8	PER-CENT		
3.7.7.2	PRESS. SENSORS	-	-	-	COST INCLUDED IN
					SUBSYSTEMS
3.7.7.3	TEMP. SENSORS	-	-	-	COST INCLUDED IN
					SUBSYSTEMS
3.7.7.4	FLOW SENSORS	-	-	-	COST INCLUDED IN
					SUBSYSTEMS
3.7.7.5	POSITION SENSORS	-	-	-	COST INCLUDED IN
					SUBSYSTEMS
3.7.7.6	DISPLAYS, DIGITAL	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.7.3	POWER CONTROL AND DISTRIBUTION				
	ASSEMBLY	-	-	Σ ASSEMBLY COSTS	
3.7.3.1	INTEG. ASSY AND C/O	5	PER-CENT		
3.7.3.2	28 VDC REGULATED CKTS.	-	-	Σ ASSEMBLY COSTS	
3.7.3.2.1	1100 W CONVERTER (ADD-UV)	-	-	DIRECT ESTIMATE	
3.7.3.2.2	WIRE HARNESS	10	POUNDS		
3.7.3.2.3	RECEPTACLES	-	-	DIRECT ESTIMATE	
3.7.3.2.4	CIRCUIT BREAKER	-	-	DIRECT ESTIMATE	
3.7.3.3	110 VAC 3Ø 400 Hz CKT	-	-	Σ ASSEMBLY COSTS	
3.7.3.3.1	WIRE HARNESS	2	POUNDS		
3.7.3.3.2	RECEPTACLES	-	-	DIRECT ESTIMATE	
3.7.3.3.3	CIRCUIT BREAKER	-	-	DIRECT ESTIMATE	
3.7.3.4	110 VAC 1Ø 400 Hz CKT	-	-	Σ ASSEMBLY COSTS	
3.7.3.4.1	WIRE HARNESS	0.5	POUNDS		
3.7.3.4.2	RECEPTACLES	-	-	DIRECT ESTIMATE	
3.7.3.4.3	CIRCUIT BREAKER	-	-	DIRECT ESTIMATE	
3.7.3.5	110 VAC 10 60 Hz CKT	-	-	Σ ASSEMBLY COSTS	
3.7.3.5.1	110 W INVERTER (ADD-UV)	-	-	DIRECT ESTIMATE	
3.7.3.5.2	WIRE HARNESS	1	POUND		
3.7.3.5.3	RECEPTACLES	-	-	DIRECT ESTIMATE	
3.7.3.5.4	CIRCUIT BREAKER	-	-	DIRECT ESTIMATE	
3.7.3.6	INSTRUMENTATION	-	-	Σ ASSEMBLY COSTS	
3.7.3.6.1	VOLTMETER	-	-	DIRECT ESTIMATE	

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.7.3.6.2	AMP METER	-	-	DIRECT ESTIMATE	
3.7.3.6.3	WATTMETER	-	-	DIRECT ESTIMATE	
3.8	OPTICAL AND IMAGING DEVICES	-	-	SUMMATION	
3.8.1	INTEG., ASSY AND C/O	8	PER-CENT		
3.8.2	CINE CAMERA (35 mm)	-	-	DIRECT ESTIMATE	
3.8.2.1	BODY	-	-	-	INCLUDED IN 3.8.2
3.8.2.2	MAGAZINE	-	-	-	INCLUDED IN 3.8.2
3.8.2.3	REELS	-	-	-	INCLUDED IN 3.8.2
3.8.2.4	OPTICS (ZOOM)	-	-	-	INCLUDED IN 3.8.2
3.8.2.5	CAMERA CONTROL UNIT	-	-	-	INCLUDED IN 3.8.2
3.8.2.6	CABLES/CONNECTORS	-	-	-	INCLUDED IN 3.8.2
3.8.2.7	MECHANICAL COUPLERS	-	-	-	INCLUDED IN 3.8.2
3.8.2.8	MOUNT	-	-	-	INCLUDED IN 3.8.2
3.8.3	STILL CAMERA (35 mm)	-	-	DIRECT ESTIMATE	
3.8.3.1	BODY	-	-	-	INCLUDED IN 3.8.3
3.8.3.2	MAGAZINE	-	-	-	INCLUDED IN 3.8.3
3.8.3.3	REELS	-	-	-	INCLUDED IN 3.8.3
3.8.3.4	OPTICS (FIXED)	-	-	-	INCLUDED IN 3.8.3
3.8.3.5	OPTICS (ZOOM)	-	-	-	INCLUDED IN 3.8.3
3.8.3.6	CAMERA CONTROL UNIT	-	-	-	INCLUDED IN 3.8.3
3.8.3.7	CABLES AND CONNECTORS	-	-	-	INCLUDED IN 3.8.3
3.8.3.8	MECHANICAL COUPLERS	-	-	-	INCLUDED IN 3.8.3
3.8.3.9	MOUNT	-	-	-	INCLUDED IN 3.8.3

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.8.4	MICROSCOPE TRINOCULAR	-	-	DIRECT ESTIMATE	
3.8.4.1	BODY	-	-	-	INCLUDED IN 3.8.4
3.8.4.2	OBJECTIVES	-	-	-	INCLUDED IN 3.8.4
3.8.4.3	NOSEPIECE	-	-	-	INCLUDED IN 3.8.4
3.8.4.4	EYEPIECE	-	-	-	INCLUDED IN 3.8.4
3.8.4.5	POLARIZING ATTACHMENTS	-	-	-	INCLUDED IN 3.8.4
3.8.4.6	CAMERA ATTACHMENT	-	-	-	INCLUDED IN 3.8.4
3.8.4.7	MECHANICAL COUPLERS	-	-	-	INCLUDED IN 3.8.4
3.8.4.8	LAMP/LAMP CONTROL	-	-	-	INCLUDED IN 3.8.4
3.8.4.9	STAND	-	-	-	INCLUDED IN 3.8.4
3.8.4.10	MOUNT	-	-	-	INCLUDED IN 3.8.4
3.8.5	VIDEO CAMERA ASSEMBLY (16 mm)	-	-	DIRECT ESTIMATE	
3.8.5.1	CAMERA	-	-	-	INCLUDED IN 3.8.5
3.8.5.2	OPTICS (ZOOM)	-	-	-	INCLUDED IN 3.8.5
3.8.5.3	CAMERA CONTROL UNIT	-	-	-	INCLUDED IN 3.8.5
3.8.5.4	CABLES AND CONNECTORS	-	-	-	INCLUDED IN 3.8.5
3.8.5.5	MECHANICAL COUPLERS	-	-	-	INCLUDED IN 3.8.5
3.8.5.6	MOUNT	-	-	-	INCLUDED IN 3.8.5

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.8.6	LIGHT SOURCE	-	-	DIRECT ESTIMATE	
3.8.6.1	BULB	-	-	-	INCLUDED IN 3.8.6
3.8.6.2	SOCKET	-	-	-	INCLUDED IN 3.8.6
3.8.6.3	LIGHT BULB OPTICS	-	-	-	INCLUDED IN 3.8.6
3.8.6.4	FILTERS	-	-	-	INCLUDED IN 3.8.6
3.8.6.5	LIGHT SOURCE HOUSING	-	-	-	INCLUDED IN 3.8.6
3.8.6.6	LIGHT CONTROLLER	-	-	-	INCLUDED IN 3.8.6
3.8.6.7	MECHANCIAL COUPLER	-	-	-	INCLUDED IN 3.8.6
3.8.7	ANENOMETER	-	-	DIRECT ESTIMATE	
3.8.7.1	OPTICS	-	-	-	INCLUDED IN 3.8.7
3.8.7.2	LASER	-	-	-	INCLUDED IN 3.8.7
3.8.7.3	BACKSCATTER UNIT	-	-	-	INCLUDED IN 3.8.7
3.8.7.4	PHOTO DETECTOR	-	-	-	INCLUDED IN 3.8.7
3.8.7.5	DUAL BEAMSPLITTER ASSY	-	-	-	INCLUDED IN 3.8.7
3.8.7.6	ELECTRONIC COUNTER	-	-	-	INCLUDED IN 3.8.7
3.8.7.7	POWER CONVERTER	-	-	-	INCLUDED IN 3.8.7
3.8.7.8	CONTROLLER	-	-	-	INCLUDED IN 3.8.7
3.8.7.9	CABLES AND CONNECTORS	-	-	-	INCLUDED IN 3.8.7
3.8.7.10	MOUNT/BASE	-	-	-	INCLUDED IN 3.8.7

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.8.8	STEREO MICROSCOPE	-	-	DIRECT ESTIMATE	
3.8.8.1	BODY	-	-	-	INCLUDED IN 3.8.8
3.8.8.2	OBJECTIVES	-	-	-	INCLUDED IN 3.8.8
3.8.8.3	NOSEPIECE	-	-	-	INCLUDED IN 3.8.8
3.8.8.4	EYEPIECE	-	-	-	INCLUDED IN 3.8.8
3.8.8.5	POLARIZING ATTACHMENT	-	-	-	INCLUDED IN 3.8.8
3.8.8.6	CAMERA ATTACHMENT	-	-	-	INCLUDED IN 3.8.8
3.8.8.7	MECHANICAL COUPLERS	-	-	-	INCLUDED IN 3.8.8
3.8.8.8	LAMP/LAMP CONTROL	-	-	-	INCLUDED IN 3.8.8
3.8.8.9	STAND	-	-	-	INCLUDED IN 3.8.8
3.8.8.10	MOUNT	-	-	-	INCLUDED IN 3.8.8
3.8.9	IR MICROSCOPE	-	-	DIRECT ESTIMATE	
3.8.9.1	BODY	-	-	-	INCLUDED IN 3.8.9
3.8.9.2	OBJECTIVES	-	-	-	INCLUDED IN 3.8.9
3.8.9.3	OPTICAL SCANNER AND DETECTOR	-	-	-	INCLUDED IN 3.8.9
3.8.9.4	IMAGE CONVERTER ELECTRONICS	-	-	-	INCLUDED IN 3.8.9
3.8.9.5	CABLES AND CONNECTORS	-	-	-	INCLUDED IN 3.8.9
3.8.9.6	THERMAL CONTROL UNIT	-	-	-	INCLUDED IN 3.8.9
3.8.9.7	MOUNT	-	-	-	INCLUDED IN 3.8.9

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
3.8.10	SUPPORT EQUIPMENT/EXPENDABLES	-	-	Σ COMPONENTS	
3.8.10.1	COUPLING OPTICS	-	-	DIRECT ESTIMATE	
3.8.10.2	EXPOSURE METER	-	-	DIRECT ESTIMATE	
3.8.10.3	SPOOLS	-	-	DIRECT ESTIMATE	
3.8.10.4	FILM (35 mm)	-	-	DIRECT ESTIMATE	
3.8.10.5	VIEWPORTS	-	-	DIRECT ESTIMATE	
3.8.11	DISPLAYS/CONTROLS	-	-	Σ ASSEMBLY COSTS	
3.8.11.1	DIGITAL	-	-	DIRECT ESTIMATE	
3.8.11.2	ANALOG	-	-	DIRECT ESTIMATE	
3.8.11.3	INDICATOR LIGHTS	-	-	DIRECT ESTIMATE	
3.8.11.4	CONTROLS	-	-	DIRECT ESTIMATE	
5.0	SYSTEM TEST	-	-	SUMMATION	*DDT&E
5.1	SYSTEM TEST PLANNING	-	-	DIRECT ESTIMATE	
5.2	MAJOR TEST ARTICLES	-	-	SUMMATION	
5.2.1	MOCK-UPS	-	-	DIRECT ESTIMATE	
5.2.2	FUNCTIONAL MODEL	-	-	DIRECT ESTIMATE	
5.2.3	PROJECT VERIFICATION MODEL	-	-	DIRECT ESTIMATE	
5.3	SYSTEM DEV. TESTING	-	-	DIRECT ESTIMATE	
5.4	SYSTEM VERIFICATION TESTING	-	-	DIRECT ESTIMATE	
6.0	GSE	-	-	SUMMATION	*DDT&E
6.1	GSE INTEGRATION	-	-	DIRECT ESTIMATE	

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9-9-74

TECHNICAL CHARACTERISTICS DATA FORM B

IDENT NO.	WBS IDENTIFICATION	QUANTITY OR VALUE	UNITS OF MEASURE	CHARACTERISTICS	NOTES
6.2	ELECTRICAL/ELECTRONIC GSE	-	-	DIRECT ESTIMATE	
6.3	MECHANICAL GSE	-	-	DIRECT ESTIMATE	
6.4	TRANSPORTATION AND HANDLING GSE	-	-	DIRECT ESTIMATE	
6.5	GSE SOFTWARE	-	-	DIRECT ESTIMATE	
8.0	LOGISTICS			SUMMATION	*DDT&E
8.1	TRAINING			DIRECT ESTIMATE	
8.2	TRANSPORTATION AND HANDLING			DIRECT ESTIMATE	
8.3	INVENTORY AND CONTROL			DIRECT ESTIMATE	
9.0	GROUND OPERATIONS			SUMMATION	*OPERATIONS
9.1	RECOVERY OPERATIONS			DIRECT ESTIMATE	
9.2	MAINTENANCE AND REFURBISHMENT			DIRECT ESTIMATE	
9.3	CHECKOUT OPERATIONS AND CERT.				
	FOR FLIGHT			DIRECT ESTIMATE	
9.4	LAUNCH OPERATIONS			DIRECT ESTIMATE	
10.0	FLIGHT OPERATIONS			SUMMATION	*OPERATIONS
10.1	MISSION PLANNING			GOVERNMENT FUNCTION	
10.2	FLIGHT CONTROL AND EVALUATION			DIRECT ESTIMATE	
11.0	PRINCIPAL INVESTIGATOR				
	OPERATIONS			SUMMATION	
11.1	P.I. PLANNING OPERATIONS			DIRECT ESTIMATE	
11.2	P.I. PREFLIGHT OPERATIONS			DIRECT ESTIMATE	
11.3	P.I. FLIGHT/POSTFLIGHT				
	OPERATIONS			DIRECT ESTIMATE	

Funding Schedule Data (NASA Data Form C)

This subsection presents, on NASA Data Form C, the Cloud Physics Laboratory project annual funding requirements by government fiscal year for the DDT&E phase, Production phase, and Operations phase. Funding estimates have been made at the System Level, except for the Cloud Physics Laboratory System for which estimates have been generated at the Subsystem Level.

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-10-74

FUNDING SCHEDULE DATA FORM C

X NONRECURRING (DDT&E)

___ RECURRING (PRODUCTION)

___ RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	TOTAL
	TOTAL PROJECT	3	1,220	8,086	8,800	3,152	75	0	0	0	0	0	0	0	21,333
1.0	PROJECT MANAGEMENT	4	73	147	147	147	36	0	0	0	0	0	0	0	550
2.0	SYSTEM ENGR. AND INTEG.	4	27	413	655	287	4	0	0	0	0	0	0	0	1,386
3.0	CLOUD PHYSICS EXP. LAB	4	1,109	7,149	6,903	1,483	0	0	0	0	0	0	0	0	16,644
3.1	FINAL ASSY INTEG., C/O	5	18	273	387	115	0	0	0	0	0	0	0	0	793
3.2	THERMAL CONTROL/														
	EXPENDABLES STORAGE														
	AND CONT.	5	186	1,151	1,011	153	0	0	0	0	0	0	0	0	2,501
3.3	PARTICLE GENERATOR	5	94	596	575	126	0	0	0	0	0	0	0	0	1,391
3.4	DATA MANAGEMENT	5	171	1,100	1,107	284	0	0	0	0	0	0	0	0	2,662
3.5	PARTICLE DETECTORS AND														
	CHARACTERIZERS	5	169	1,073	1,073	227	0	0	0	0	0	0	0	0	2,506
3.6	EXPERIMENT CHAMBERS	5	182	1,153	1,114	244	0	0	0	0	0	0	0	0	2,693
3.7	CONSOLE	5	134	816	679	82	0	0	0	0	0	0	0	0	1,711
3.8	OPTICAL DETECTION AND														
	IMAGING DEVICES	5	154	986	992	255	0	0	0	0	0	0	0	0	2,387
4.0	EXPERIMENT SUPPORT														
	HARDWARE	4	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0	SYSTEM TEST	4	9	150	265	134	0	0	0	0	0	0	0	0	558
6.0	GSE	4	3	227	566	417	20	0	0	0	0	0	0	0	1,233

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-10-74

PAGE 2 OF 6

FUNDING SCHEDULE DATA FORM C

X NONRECURRING (DDT&E)

— RECURRING (PRODUCTION)

— RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	TOTAL
7.0	FACILITIES	4	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0	LOGISTICS	4	0	0	265	682	15	0	0	0	0	0	0	0	962
9.0	GROUND OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0	FLIGHT OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0
11.0	P.I. OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-10-74

PAGE 3 OF 6

FUNDING SCHEDULE DATA FORM C

___ NONRECURRING (DDT&E)

X RECURRING (PRODUCTION)

___ RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	TOTAL
	TOTAL PROJECT	3	0	959	3,343	2,383	197	0	0	0	0	0	0	0	6,882
1.0	PROJECT MANAGEMENT	4	0	30	91	91	61	0	0	0	0	0	0	0	273
2.0	SYSTEM ENGR. AND INTEG.	4	0	5	178	295	111	0	0	0	0	0	0	0	589
3.0	CLOUD PHYSICS EXP. LAB.	4	0	924	3,060	1,952	25	0	0	0	0	0	0	0	5,961
3.1	FINAL ASSY INTEG, AND C/O	5	0	0	14	234	25	0	0	0	0	0	0	0	273
3.2	THERMAL CONTROL/														
	EXPENDABLES STORAGE														
	AND CONT.	5	0	136	456	272	0	0	0	0	0	0	0	0	864
3.3	PARTICLE GENERATORS	5	0	56	188	113	0	0	0	0	0	0	0	0	357
3.4	DATA MANAGEMENT	5	0	124	418	249	0	0	0	0	0	0	0	0	791
3.5	PARTICLE DETECTORS AND														
	CHARACTERIZERS	5	0	122	408	244	0	0	0	0	0	0	0	0	774
3.6	EXPERIMENT CHAMBERS	5	0	235	787	470	0	0	0	0	0	0	0	0	1,492
3.7	CONSOLE	5	0	154	463	175	0	0	0	0	0	0	0	0	792
3.8	OPTICAL DETECTION AND														
	IMAGING DEVICES	5	0	97	326	195	0	0	0	0	0	0	0	0	618
4.0	EXPERIMENT SUPPORT														
	HARDWARE	4	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0	SYSTEM TEST	4	0	0	0	0	0	0	0	0	0	0	0	0	0
6.0	GSE	4	0	0	14	40	0	0	0	0	0	0	0	0	54

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-10-74

PAGE 4 OF 6

FUNDING SCHEDULE DATA FORM C

___ NONRECURRING (DDT&E)

_X_ RECURRING (PRODUCTION)

___ RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	TOTAL
7.0	FACILITIES	4	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0	LOGISTICS	4	0	0	0	5	0	0	0	0	0	0	0	0	5
9.0	GROUND OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0	FLIGHT OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0
11.0	P.I. OPERATIONS	4	0	0	0	0	0	0	0	0	0	0	0	0	0

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY – CONTRACT NAS8-30272

DATE 9-10-74

FUNDING SCHEDULE DATA FORM C

___ NONRECURRING (DDT&E)

___ RECURRING (PRODUCTION)

X RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	TOTAL
	TOTAL PROJECT	3	661	1,496	1,501	1,501	1,501	1,501	1,501	1,501	1,501	1,501	1,501	1,066	16,732
1.0	PROJECT MANAGEMENT	4	10	41	41	41	41	41	41	41	41	41	41	29	449
2.0	SYSTEM ENGR. AND INTEG.	4	14	58	58	58	58	58	58	58	58	58	58	40	634
3.0	CLOUD PHYSICS EXP. LAB.	4	347	234	234	234	234	234	234	234	234	234	234	127	2,814
3.1	FINAL ASSY, INTEG. AND C/O	5	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2	THERMAL CONTROL/ EXPENDABLES STORAGE AND CONT.	5	119	81	81	81	81	81	81	81	81	81	81	40	969
3.3	PACTICLE GENERATORS	5	14	12	12	12	12	12	12	12	12	12	12	6	140
3.4	DATA MANAGEMENT	5	44	29	29	29	29	29	29	29	29	29	29	18	352
3.5	PARTICLE DETECTORS AND CHARACTERIZERS	5	38	25	25	25	25	25	25	25	25	25	25	16	304
3.6	EXPERIMENT CHAMBERS	5	71	49	49	49	49	49	49	49	49	49	49	24	585
3.7	CONSOLE	5	10	4	4	4	4	4	4	4	4	4	4	3	53
3.8	OPTICAL DETECTION AND IMAGING DEVICES	5	51	34	34	34	34	34	34	34	34	34	34	20	411
4.0	EXPERIMENT SUPPORT HARDWARE	4	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0	SYSTEM TEST	4	0	0	0	0	0	0	0	0	0	0	0	0	0
6.0	GSE	4	14	54	54	54	54	54	54	54	54	54	54	41	595

ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY — CONTRACT NAS8-30272

DATE 9-10-74

PAGE 6 OF 6

FUNDING SCHEDULE DATA FORM C

___ NONRECURRING (DDT&E)

___ RECURRING (PRODUCTION)

X RECURRING (OPERATIONS)

COSTS ARE IN THOUSANDS OF 1974 DOLLARS

IDENT NO.	WBS IDENTIFICATION	WBS LEVEL	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	TOTAL
7.0	FACILITIES	4	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0	LOGISTICS	4	4	15	15	15	15	15	15	15	15	15	15	7	161
9.0	GROUND OPERATIONS	4	117	469	469	469	469	469	469	469	469	469	469	347	5,154
10.0	FLIGHT OPERATIONS	4	0	7	12	12	12	12	12	12	12	12	12	7	122
11.0	P.I. OPERATIONS	4	155	618	618	618	618	618	618	618	618	618	618	468	6,803

BIBLIOGRAPHY

1. Study Bulletin 74. 2 - SRT Technology Definition, 31 January 1974
2. Study Bulletin 74. 3 - Cost Methodology, 4 February 1974
3. Study Bulletin 74. 4 - Cost Methodology, Operating Costs, 6 February 1974
4. Study Bulletin 74. 5 - Cost Criteria, 7 February 1974
5. Study Bulletin 74. 6 - Guidelines and Design Features, 7 February 1974
6. Study Bulletin 74. 7 - Cost Estimate Calculations and Reporting, 14 February 1974
7. Study Bulletin 74. 10 - Schedule Analysis Methodology, 13 March 1974
8. Study Bulletin 74. 11 - Approved Work Breakdown Structure and Dictionary, 18 March 1974 - as revised 6 September 1974
9. Study Bulletin 74. 26 - Preliminary Test Philosophy and Test Plan, 29 April 1974
10. Study Bulletin 74. 32 - Quantification of Porgram Cost Impacts on Various Reliability Levels, 11 June 1974.
11. Study Bulletin 74. 51 - CPL Maintainability Guidance and Recommendations, 11 July 1974.

Section 4
SUPPORTING RESEARCH AND TECHNOLOGY

4.1 ASSESSMENT AND RECOMMENDATION

An assessment of the Cloud Physics Laboratory SRT has been performed. This assessment was weighted to reflect the requirements of the current definition, evaluated from the standpoint of schedule and cost factors, and ranked from an overall payload viewpoint. This approach was followed to provide a perspective of the SRT items, and the results are presented in Table 4-1. The headings of Table 4-1 are explained in the following sections.

4.2 TECHNICAL ASSESSMENT

The detailed SRT data sheets have been formulated by the appropriate subsystem personnel in conjunction with the Project Scientist. In addition to the description, technology, benefits, schedule and cost factors provided, initial weighting factors were established. These weighting factors or rankings fall into three general categories:

4.2.1 Priority

1. Mandatory — SRT tasks which must be completed, or else there will be a significant risk in achieving performance and/or schedule requirements. These tasks are critical to the success of CPL buildup and initial operational capability (IOC).
2. Desirable — SRT tasks which are considered beneficial and/or cost effective, i.e., a small initial investment would achieve one or more of the following: increased reliability; decreased weight; improved or more efficient operations; lower cost. However, these SRT tasks are not critical and, therefore, could be excluded if there were severe budget restrictions.
3. Potential — SRT tasks which appear promising, but do not seem to offer quite the same or degree of improvements of those tasks in Priority 2 to warrant a substitution. However, further effort could result in their replacing the approach taken in the baseline.

Table 4-1

ZERO-GRAVITY CLOUD PHYSICS EXPERIMENT LABORATORY

SRT ASSESSMENT

SRT	SRT Title	Category	Priority	Ranking	Cost (10^3)
1	Particle Injector and Size Conditioner	AD*	Mandatory	1	$ 350
2	Chamber Wall Subassembly	AD	Mandatory	2	275
3	Acoustical Subassembly	AD	Mandatory	3	225
4	Electric Field Subassembly	AD	Mandatory	4	210
5	Optical Subassembly	AD	Mandatory	5	200
6	Cloud Optical Characterizer	AD	Mandatory	6	330
7	Water Wicking Surfaces	AD	Mandatory	7	140
8	Earth Simulation Model	AD	Mandatory	8	240
				Total	$1970

*AD = Advanced Development

4.2.2 Cost

SRT costs are the estimated 1974 dollars for performing the SRT tasks described on each respective detailed data sheet. Costs to perform SRT tasks associated with other categories are not included. For example, if one SRT task is in the Advanced Technology category, there will be a cost estimate for performing the Advanced Technology task. If additional SRT work is required in the Advanced Development category and perhaps Supporting Development work will be required at a later date, each of latter SRT categories will be identified on a separate detailed data sheet which has its own estimate.

4.2.3 Schedule

The SRT schedule is the estimated time in months for performing the SRT task described on each detailed data sheet. Schedule times for performing tasks associated with other SRT categories are not included. For example, if one SRT task is in the Advanced Technology category, there will be a schedule for performing the Advanced Technology task. If additional work is required in the Advanced Development category and perhaps some subsequent Supporting Development, each of these latter SRT categories will be identified on a separate detailed data sheet which has its respective schedules.

4.3 PROGRAMMATIC ASSESSMENT

The programmatic assessment was performed using the schedule relationship between the Cloud Physics Laboratory and the SRT activities shown in Figure 4-1. The starting dates for each of the SRT categories are purposely not extended in the project in an effort to minimize cost. Items could be initiated earlier than shown and completed in low risk areas; however, the earlier the start, the greater the risk that the design effort may have proceeded on a different approach. Premature false starts can increase project cost. Conversely, sufficient data must be available for meaningful design effort and these data can only be obtained by the performance of SRT efforts. Increased project development and production cost, slippage of project schedule and experiment timeline inefficiency (increased operations cost) can result if these data are not available. For the unique Cloud Physics Laboratory equipment it is deemed reasonable, practical, and cost effective to initiate specific SRT efforts on schedule to permit support of design efforts. In general, to minimize development risk for the project, Research (R) should be completed prior to Phase B, Advanced Technology (AT) should be completed prior to Phase C start, Advanced Development (AD) should be completed prior to Phase D start and initiation of the Preliminary Design Review (PDR), and Supporting Development (SD) on alternate approaches should be terminated prior to completion of the Critical Design Review (CDR) as shown in Figure 4-1.

CR76

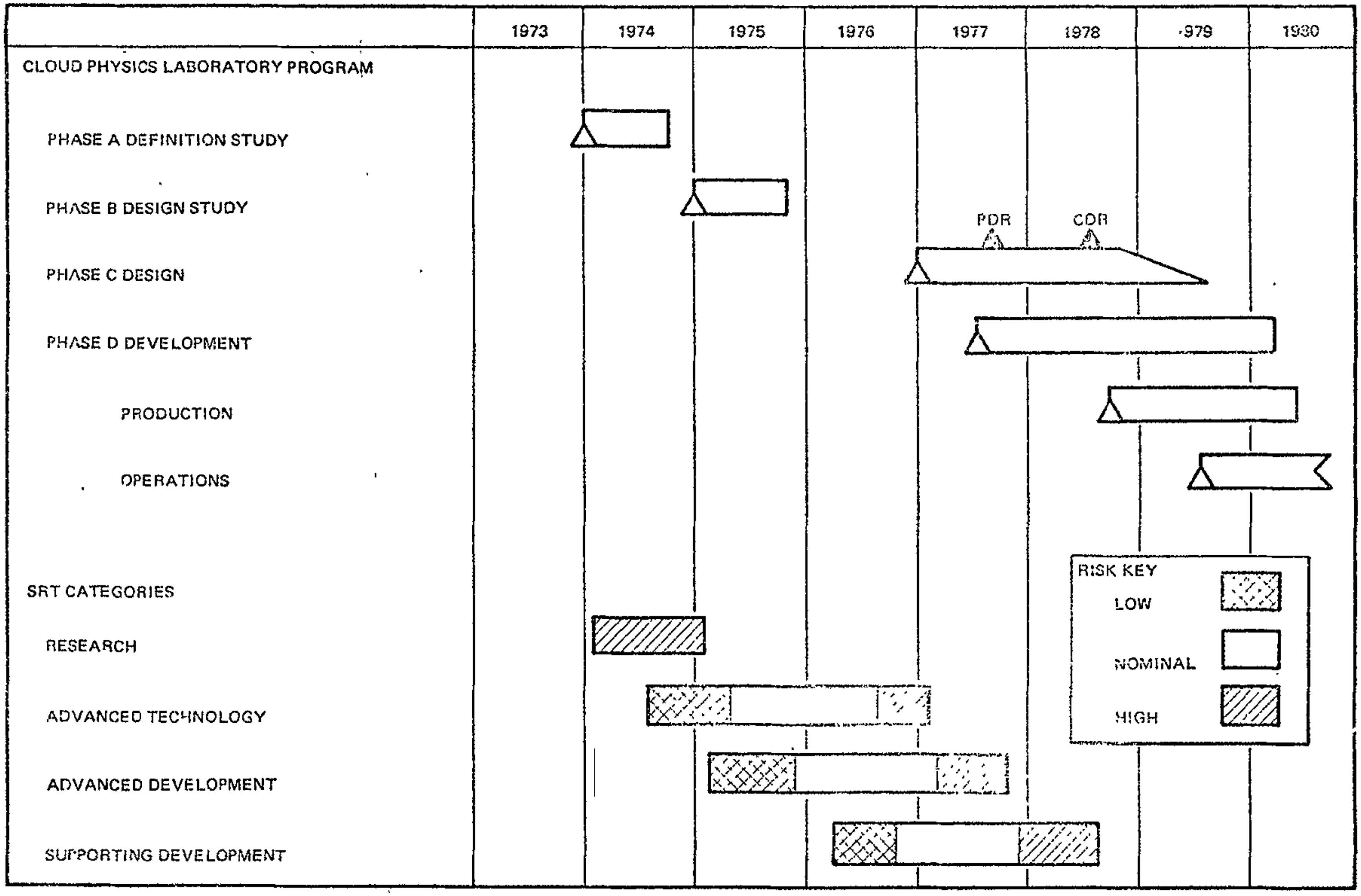


Figure 4-1. Schedule Relationship Cloud Physics Laboratory Development and SRT

4.3.1 Schedule Risk

Schedule risk classification is determined by comparing the SRT task schedule to the Cloud Physics Experiment Laboratory baseline schedule and its constraints (reference attached schedule comparison). In general, the following definitions apply, although specific exceptions may arise.

SRT Category	Schedule Risk	
Research (R)	High	- Assumes programmatic implications. - If completion is scheduled after start of Phase B. - If the research is Mandatory (Priority 1).
Advanced Technology (AT)	High	- If AT is Mandatory. - If completion is scheduled after start of Phase C.
	Nominal	- If AT is Desirable (Priority 2) - If completion is scheduled prior to start of Phase C. - If AT task appears to benefit Phase A and Phase B activities.
	Low	- If AT is Potential (Priority 3) - If completion is scheduled significantly before start of Phase C.
Advanced Development (AD)	High	- If AD is Mandatory (Priority 1). - If completion is scheduled after start of Phase C, but prior to PDR. - If AD task appears to offer limited benefit to overall Phase C activity.
	Nominal	- If AD is Desirable (Priority 2). - If start is prior to Phase C and completion is scheduled prior to PDR. - If the task appears to offer moderate benefit to overall Phase C activity.

	Low	- If AD is Potential (Priority 3). - If both start and completion are scheduled prior to start of Phase C. - If the task appears to offer significant benefit to overall Phase C activity.
Supporting Development (SD)	High	- If SD is Mandatory (Priority 1). - If start is after Phase C PDR, but prior to Phase C CDR. - If SD task appears to offer limited benefit to overall Phase C activity.
	Nominal	- If SD is Desirable (Priority 2). - If start is prior to Phase C PDR and completion is scheduled prior to Phase C CDR. - If SD task appears to offer moderate benefit to overall Phase C activity.
	Low	- If SD is Potential (Priority 3). - If both start and completion are scheduled prior to Phase C PDR. - If SD task appears to offer significant benefit to overall Phase C activity.

4.3.2 Program Critical

SRT tasks are considered Program Critical if they have been identified as follows:

1.	SRT Category	-	Research
	Schedule Risk	-	High
	Priority	-	1 - Mandatory
2.	SRT Category	-	Advanced Technology
	Schedule Risk	-	High
	Priority	-	1 - Mandatory

Other SRT tasks which have lesser classifications are not considered to be Program Critical.

4.4 OVERALL SYSTEM RANKING

The objective of the importance ranking is to interrelate the candidate SRT tasks according to their relative importance to the Cloud Physics Laboratory. The following numerical assignments were made to establish a consistent basis for quantifying the importance of the SRT tasks. The lowest assigned number equates to the highest rank within each of the elements contributing to the total score, and the lowest total score is for the highest rank.

	Rank No.	Element
1.		SRT Category
	1	Supporting Development - SD
	2	Advanced Development - AD
	3	Advanced Technology - AT
	4	Research - R
2.		Schedule Risk
	1	Low
	2	Nominal
	3	High
3.		Priority
	1	Mandatory
	2	Desirable
	3	Potential
4.		Program Critical
	1	No
	2	Yes
5.		Impact
	1	Safety Contamination Requirements Subsystem Capability
	2	Reliability Maintainability Flexibility
	3	Mission Experiment Time Experiment Data Quality Experiment Data Quantity
	4	Ground Refurbishment/Maintenance

4.5 SUPPORTING RESEARCH AND TECHNOLOGY CATEGORIES

4.5.1 Research (R)

Research is the activity directed twoard an increase in scientific and engineering knowledge intended to provide high confidence in proposed problem solutions. When the research has programmatic implications, it is applied rather than basic research, and addresses only the Conceptual Phase (Phase A) of Phased Project Planning. To minimize program cost and risk, any items in this category should normally be completed by the time Phase B is initiated.

4.5.2 Advanced Technology (AT)

Advanced Technology is the activity of advancing the state of the art in the field of methods and techniques through the application of science and engineering. Any associated hardware effort does not go beyond that required to demonstrate the validity of the advanced method of technique. The AT category of SRT is concerned primarily with the Conceptual Phase (Phase A) and only has a secondary concern with the Definition Phase (Phase B). The activity should be completed before the start of the Design/ Development Phase (Phase C), if program risk and cost are to be minimized.

4.5.3 Advanced Development (AD)

Advanced Development is the activity of developing systems, subsystems, or components which are recognized as having long development times and the development completion is required prior to Phase D - Production approval on the project in which the developments will be utilized. The prime reason for accomplishing this category of SRT is to strengthen the performance requirement portion of the respective specification for each specific hardware item. The technology is present state of the art and the broad feasibility has been proven. There remains the AD task of integrating the specific elements into a workable subsystem/system and demonstrating operational capability. The activity usually starts during the Definition Phase (Phase B), but it may start some months prior to this time and extend into the Design Phase (Phase C).

4.5.4 Supporting Development (SD)

Supporting Development is the activity of developing: (1) backup or alternate systems, subsystems, or components; and (2) fabrication, cost and evaluation techniques. Advances in the state of the art may or may not be incorporated. The products of this activity are hardware or techniques suitable for replacing their primary counterparts in the development program. The SD category of SRT is primarily concerned with the Design Phase (Phase C). Initiation of this activity during Phase C should accelerate the baseline development schedule and reduce program risk.

4.6 SUPPORTING RESEARCH AND TECHNOLOGY - TECHNOLOGY AREAS

4.6.1 Acoustics/Acoustical

This technology area pertaining to acoustic frequency generating equipment. Acoustical drivers, microphone pickup, amplifiers, and phase-lock loop controllers are included in this category.

4.6.2 Fluid Dynamics

This technology area pertains to liquid containment and flow control equipment. Reservoirs, flow tubes, capillary surfaces, and flow restrictors are included in this category.

4.6.3 Electromechanical

This technology area pertains to equipment incorporating both electrical and mechanical design features and their control. It includes a broad spectrum of elements/components and their interaction operation.

4.6.4 Optics/Optical

This technology area pertains to light generation and detection equipment which includes laser sources, high intensity light sources, conventional light sources, optical filters, focusing optics, and their support elements.

4.6.5 Structural/Mechanical

This technology area pertains to structural and mechanical equipment. The chemical analysis, stress characteristics, mechanical design, and manufacturing techniques of equipment are included in this category.

4.6.6 Thermal

This technology area pertains to heat transfer equipment. Heat pipes, thermoelectric modules, heat exchanger manifolds, insulation coolant baths, and coolants are included in this area.

4.7 SUPPORTING RESEARCH AND TECHNOLOGY - ITEMS

The SRT identified for the Cloud Physics Laboratory was evaluated for classification into Research, Advanced Technology, Advanced Development, and Supporting Development categories. The Cloud Physics Laboratory SRT items were found to be in the Advanced Development category.

Detailed data for each SRT item are presented in the following pages. Each item includes (1) a description of the SRT item as conceived and why it is required, (2) a brief discussion of the status of the technology and the effort to be accomplished by the SRT, and (3) the project and specific experiment classes affected. Also included are the benefits to be derived by the SRT, the time span required for development and the estimated cost.

PARTICLE GENERATORS SUBSYSTEM

1. ITEM: PARTICLE INJECTOR AND SIZE CONDITIONER
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: STRUCTURAL/MECHANICAL/THERMAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

Supercooled water droplets and single ice crystals of precise size and "structure" are required by a portion of the defined experiment program. These droplets and crystals must be grown in a precisely controlled temperature, pressure and relative humidity environment and then propelled to the appropriate position or with an appropriate velocity and direction into the cloud chamber. The envisioned particle injector and size conditioner contains features to accomplish these requirements. The particle injector and size conditioner is a miniature thermal diffusion chamber incorporating the features described for the chamber wall subassembly and the acoustical and/or optical conditioning subassembly. The device would contain appropriate viewports and accommodate installation of a generator to provide the original particle.

B. TECHNOLOGY AVAILABLE

The particle injector and size conditioner is classified as laboratory equipment. Elements of this device are used separately in terrestrial laboratories. The primary objectives of the development effort are (1) to perform analyses to establish device size, environment control range and tolerances, geometric shape, viewport location, generator mounting location, and particle injection velocity range, control and tolerance; (2) analytically evaluate the interface requirements between the device and the cloud chamber; and (3) fabricate and test a preprototype device to provide assurance of concept adequacy and to refine requirements and design features for the equipment.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

Classes 2, 3, 4, 5, 6, 7, 8 and 12

D. BENEFITS

The development effort will provide the required analysis, design, and test data necessary for confidence that the particle injector and size conditioner can be developed in accordance with project schedule. Accomplishment will permit conduct of experiments requiring particle "collision" or "dynamic" features. Experiment timeline efficiency necessitates the generation and positioning (including velocity and direction control) of particles to be performed in a predictable manner.

E. SCHEDULE 21 months

F. COST $360, 000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: CHAMBER WALL SUBASSEMBLY
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: STRUCTURAL/MECHANICAL/THERMAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The thermally controlled walls of the cloud chamber must be accurately maintained, with a very precise uniformity for all experiments. The chamber wall subassembly to satisfy the experiment requirements consists of heat pipe cavity wall surfaces, thermoelectric modules, heat exchanger/manifold, and outer wall shell. The heat pipe cavity wall surfaces provide the chamber thermal environment control to ± 0.2°C with a thermal uniformity of ± 0.02°C. The thermoelectric modules provide a heat pump capability and accomplish both heating and cooling of the wall surfaces. The insulation is utilized to reduce the thermal leakage from the chambers and to enhance thermal uniformity. The heat exchanger/manifold provides the coolant distribution between the thermoelectric modules and the Spacelab coldplate (10°C). The outer wall shell provides the cloud chamber structural integrity and protection for chamber wall elements.

B. TECHNOLOGY AVAILABLE

The chamber wall subassembly is classified as laboratory equipment. Operating terrestrial laboratories use water-cooled chamber walls and the associated large thermal baths. Effort has been expended on use of thermoelectrics, but without heat pipes, for chamber wall thermal control. Chamber design development efforts have been conducted and have established the feasibility of the heat pipe/thermoelectric module concept for chamber wall subassembly usage. The development requirements of this effort necessitate analysis, design and test of chamber wall subassembly

elements. Alternate heat pipe surface concepts must be evaluated for thermal control and uniformity. The technique for thermoelectric mounting and mount location on heat pipe surfaces must be evaluated. The selection of material insulation and thickness and the heat exchanger configuration and coolant flow must be established. The integration of adjacent wall surfaces and the thermal control of chamber wall surfaces to the required tolerances must be demonstrated.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

Classes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20.

D. BENEFITS

This development effort will provide the required analysis, design and test data necessary for confidence that the cloud chambers can be developed in accordance with project schedule. The cloud chamber thermal control is required for all experimentation envisioned. Cloud chamber physical and operational characteristics are predicted on the usage of the heat pipe thermoelectric modules chamber wall concept. Accomplishment will reduce project risk for this equipment and maintain the predicted experiment timeline efficiency.

E. SCHEDULE 18 months

F. COST $275, 000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: ACOUSTICAL SUBASSEMBLY
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: ACOUSTICS/ACOUSTICAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The acoustical subassembly provides motion and orientation control of droplets and ice crystals within the cloud chamber, and, in specific instances exact orientation control of ice crystal. Up to three axes of acoustical control may be required. The subassembly will consist of acoustical sources, microphone pickup/amplifiers, phase-lock loop controller, and power amplifier. The acoustical sources provide the sound waves utilizing electrical drive. The microphone pickup/amplifier detects the acoustic wave and generates a signal to provide feedback to the controller. The phase-lock loop controller processes the driving frequency information to maintain the desired acoustic standing wave pattern. The power amplifier transforms the control signal to the level appropriate for the acoustical drivers.

B. TECHNOLOGY AVAILABLE

The acoustical subassembly is classified as laboratory equipment, although some components are commercial state of the art. NASA is presently performing a development effort (Jet Propulsion Laboratory) on an acoustical subassembly for the Space Processing Payload. The progress of this effort will be used as a basis for development of an acoustical subassembly for the Cloud Physics Laboratory. This effort is to establish the acoustical level determination and the required positioning feedback control required. The design aspects of different cloud chamber geometries and surfaces must be evaluated to establish acoustic driver design.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected.

Classes 2, 3, 4, 5, 6, 7, 9, 10, 13, 17, 18 and 20.

D. BENEFITS

This development effort will provide the required design and test data necessary for confidence that the acoustical subassembly can be developed in accordance with the project schedule. Accomplishment will enhance operation of four cloud chambers and over 50 percent of the experiment classes. Experiment timelines efficiency and observation of large particles over long time periods are dependent on this development.

E. SCHEDULE 15 months

F. COST $225,000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: ELECTRIC FIELD SUBASSEMBLY
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: ELECTRONIC/ELECTRICAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The electric field subassembly will provide a uniform electric field in which droplets and ice crystals can be grown and within which dynamic cloud electrification studies of combinations of particles can be performed. The subassembly consists of field "plates," ac field controller, dc field controller, and a power converter. The field "plate" geometry will be different for each cloud chamber. These "plates" will be positioned adjacent to the chamber walls and incorporate the appropriate electrical standoffs required for electrical isolation in a high humidity environment. The "plates" furthermore, must permit the free transport of water vapor from the upper to the lower diffusion cloud chambers' wicking surfaces. The ac field controller is a programmable unit that provides signal frequency and amplitude control. The dc field controller is similar to the ac field controller but provides only voltage amplitude control. The power controller supplies the appropriate high voltages for the electric field "plates."

B. TECHNOLOGY AVAILABLE

The electric field subassembly is classified as laboratory equipment. The basic components of the subassembly are commercial state of the art. The prime development requirement is to reconfigure the terrestrial laboratory equipment to manned aerospace configurations usable for the various cloud chambers. Of particular importance are the definition of the field "plates" and the electrical isolation of the subassembly high voltages. Additionally, effort must be expended in the development of programmable field controllers.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

Classes 2, 3, 4, 5, 6, 7, 8, 10, 14, 17, 18, and 20.

D. BENEFITS

The development effort will provide the required analysis, design and test data necessary for confidence that the electric field subassembly can be developed in accordance with project schedule. This subassembly is required for all charge measurement experiments. Accomplishment will reduce project risk for this equipment.

E. SCHEDULE 15 months

F. COST $210,000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: OPTICAL CONDITIONING SUBASSEMBLY
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: OPTICS/OPTICAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The optical conditioning subassembly will provide remote heating of droplets and ice crystals in a cloud chamber. Additionally, this subassembly will be used for positioning of particles by impingement of a highly configured light beam of a nonabsorbing wavelength. The subassembly consists of a light source with appropriate filters, focusing optics, protective housing, and fan. The high-intensity light source provides the appropriate wavelength for particle remote heating or positioning. The optics will focus the light source to image sizes of 1 mm or smaller. The protective housing and fan will permit beam positioning and provide the forced air cooling of the light source.

B. TECHNOLOGY AVAILABLE

The optical subassembly is classified as laboratory equipment. Optical positioning has been demonstrated in terrestrial laboratories for 20-micrometer-diameter particles. A number of radiative optical sources are presently available. Specific selection, determination of beam and filter requirements, beam aiming and control techniques are to be accomplished by this effort. Theory and laboratory effort indicate that wavelength, beam shape, and beam power can be appropriately selected for the optical subassembly requirements.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

Classes 3, 5, 7, 8, 10, 12, 17, 18, and 20.

D. BENEFITS

This development effort will provide the required analysis, design, and test data necessary for confidence that the optical subassembly can be developed in accordance with the project schedule. Accomplishment will enhance those equipments requiring individual particle remote heating and/or positioning. Use of the optical subassembly is necessary for efficient experiment timeline operation and to extend observational duration of particles.

E. SCHEDULE 15 months

F. COST $200, 000

PARTICLE CHARACTERIZERS AND DETECTORS SUBSYSTEM

1. ITEM: CLOUD OPTICAL CHARACTERIZER
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: OPTICAL/ELECTROMECHANICAL
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The cloud optical characterizer is a prime element of the scatterometer, liquid water content meter, and the droplet size distribution meter. Although the cloud optical characterizer is used in different operating modes, in each of these devices the basic elements are identical. The laser source, the optical detector, the alignment mechanism, and the scanning mechanism (used only for the scatterometer) are contained in the cloud optical characterizer. The laser source emits a continuous beam of coherent light, expanded by means of a beam expander, across the sample. The optical detector is positioned beyond the sample and detects the diffraction pattern which depends only on the dimensions of the particles in the sample. Single or multiple detectors are used, with and without scanning depending on the desired output data form and use.

B. TECHNOLOGY AVAILABLE

The cloud optical characterizer is classified as laboratory equipment, although commercial devices exist for specific uses. The laser light source exists and the optical detector technology advances of recent years are significant. The development areas for the cloud optical characterizer consist of analysis, design, fabrication, integration, test and evaluation of the components with consideration of its use in the configurations and operating modes required by the scatterometer, the liquid water content meter and the droplet size distribution meter. Additionally, the characterization of the cloud optical characterizer must be accomplished to provide assurance that data can be accurately evaluated (calibration against known standards).

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 14, 15, and 20.

D. BENEFITS

This development effort is required to provide the required design and test data necessary for confidence that the cloud optical characterizer can be developed in accordance with the project schedule. Accomplishment will enhance the quality and quantity of experimental data available and permit a high degree of commonality for scatterometer, liquid water content meter, and droplet size distribution meter design.

E. SCHEDULE 15 months

F. COST $330, 000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: WATER WICKING SURFACES
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: FLUID DYNAMICS
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The water wicking surfaces of the diffusion chambers are fine wire mesh screens or equivalent capillary material surfaces that permit the establishment of the required chamber relative humidity. The surfaces must be maintained at a thickness of less than 0.3 mm. The surfaces are critical to the free transport of water vapor and must be maintained "clean" and free of surface contaminants. Requirements exist for both periodic change of water and the continuous flow of water on these surfaces.

B. TECHNOLOGY AVAILABLE

The water wicking surfaces are classified as laboratory equipment. Terrestrial laboratory surfaces are constructed of felt, paper, or similar materials and are prewetted or utilize gravity for initial saturation. The surfaces use gravity for both addition and removal of water. The surfaces are removed from the chambers for cleaning/replacement or maintenance. The water wicking surface development areas consist of a selection of a material that is self-wetting and the determination of design features that permit the addition, removal, and flow of water on the surfaces in a near-zero-gravity environment. Additional efforts are required to establish the formation of ice on these surfaces and its subsequent melting and removal.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Classes are affected:

Classes 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 15, 16, 17, 18, 19, and 20.

D. BENEFITS

This development effort is required to permit efficient experiment operation. Accomplishment of this development will enhance diffusion cloud chamber design, permit accomplishment of experimentation in less time and enhance chamber operational characteristics.

E. SCHEDULE 12 months

F. COST $140, 000

EXPERIMENT CHAMBERS AND AEROSOL CONDITIONING SUBSYSTEM

1. ITEM: EARTH SIMULATION MODEL
2. CATEGORY: ADVANCED DEVELOPMENT
3. TECHNOLOGY AREA: STRUCTURAL/MECHANICAL/FLUID DYNAMICS
4. DESCRIPTIVE DATA:

A. DESCRIPTION

The earth simulation model will simulate specific aspects of planetary and solar convection. The assembly consists of a differentially heated rotating spherical annulus of dielectric fluid containing suspended particles to provide a visual tag of fluid circulation. The inner and outer concentric spheres encapsulating the dielectric fluid provide simulated radial gravitational gradients and incorporate features to permit variable rotation rate and thermal heating. The outer sphere consists of a transparent upper hemisphere and a metallic lower hemisphere with electrically conductive inner surfaces. The optical properties of the upper hemisphere must be of a uniformity required for direct photography of the dielectric fluid and suspended particles. The inner sphere must be electrically and thermally conductive. The dielectric fluid strength is required to permit upwards of 20 kv/cm electric field, and the suspended particles must be of several micrometer for photographic data or submicrometer size for use with a laser anemometer.

B. TECHNOLOGY AVAILABLE

The earth simulation model is classified as laboratory equipment. For terrestrial research, a model has been developed and tested. The experiment utilizing this model has been proposed for space flight. The effort for design, development, test, and evaluation of the earth simulation model for space flight has not been performed. The prime development requirement is to refine the model analysis to permit selection of materials, surface coatings, dielectric fluid and particulates. A preprototype model must be

fabricated and evaluated in a terrestrial environment to provide assurance of concept adequacy and establish requirements for model operation and control.

C. PROJECT AFFECTED

Zero Gravity Atmospheric Cloud Physics Laboratory. The following Experiment Class is affected:

Class 21

D. BENEFITS

This development effort will provide the required analysis, design and test data necessary for confidence that the earth simulation model can be developed in accordance with the project schedule. Accomplishment will reduce project risk for this equipment.

E. SCHEDULE 15 months

F. COST $240, 000

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

5301 Bolsa Avenue, Huntington Beach, California 92647 (714) 897-0311